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CONTENTS.

	Page.
ILLUSTRATED ARTICLES:	
On a Thermopile and Galvanometer Combined	208
Lighting Bartholdi's Statue of Liberty	209
Schlesinger's Electric Street Railway System	211
Some New Lecture Experiments	213
A New Form of Motor	213
A Method of Measuring the Electromotive Force of the Voltaic Arc	213
An Improved Burglar Alarm	214
A Powerful Telephone Transmitter	214
EDITORIAL PARAGRAPHS	207
MISCELLANEOUS:	
Utilizing the Residual Liquid of Bichromate Batteries	208
The Rivalry between the Telegraph and the Telephone	208
The Mutual Insurance of Electric Lighting Plants	208
Compass Errors	210
An Appliance for Preventing the Interment of Persons in Cases of Suspended Animation	210
The Telephone in Texas Railway Offices	210
MISCELLANEOUS:	
A New Application of the Photophone	210
Miller's Portable Tangent Magnetometer	212
The Sprague System of Electric Motors (concluded)	212
The Work of an English Telephone Company	212
The Underground Wire Problem	213
Wiring the Multiple Switch-Board	214
The Legal Status of Bucket Shops	214
Self-Induction of Voltmeter Coils	214
DEPARTMENTS:	
New York Notes	215
New England Notes	215
Pennsylvania Notes	215
Western Notes	216
The Telegraph	216
The Telephone	216
The Electric Light	217
Applications of Power	217
Miscellaneous Notes	217
Personals	217
Sparks and Flashes	217
Stock Quotations	217
Business Notices	217
Our Illustrated Record of Electrical Patents	217-8

New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

	Page.
Thomson-Houston Electric Co.—Automatic System of Electric Lighting	ii
E. P. Hampson & Co.—Engineers and Contractors for Steam Plants	xi
J. Ulrich & Co.—Fountain Pens	218
Wants and For Sale Advertisements	218

Vol. VIII. NEW YORK, OCT. 30, 1886. No. 18.

IN Europe, not less than in this country, the attention of all interested in street-car lines is fixed on electricity as the best means of suburban locomotion. This is not to be wondered at. The merits of electric motors for this work are so great that every one must be impressed with them. In an interesting review of the present hopeful situation in England, the London *Electrician* says: "Almost every one of the public objections to the laying down of tramway lines would disappear were it known that they are to be worked by electrical power." This is strong, but perfectly true.

A NOTE by a correspondent in another column draws attention to a curious mode of obtaining power for running dynamos and adapted to some localities. We gave an account some time ago of the application of water power to drive dynamos, but did not include the prospective methods available for this purpose. As our correspondent points out, there is no reason why artesian wells, if capable of delivering a sufficient quantity of water and of rising to a sufficient height, should not be set to work for the purpose of lighting and power distribution. We think the matter quite worthy of consideration, and hope to see the method put in practical operation for the work suggested.

THE utilization of waste products has always found more favor in European countries than in our own, where the natural resources are so great that it hardly pays to seek to convert waste products into marketable forms. Still, something is occasionally done in that direction as a novelty; for instance, the conversion of the spent liquid of bichromate batteries into material for use with less strong batteries claims attention. The inventor of the process claims that the decrease in power of the bichromate battery is not so much due to the diminished power of the liquid excitant as to the increase of resistance developed. While the idea is a novel one, its practical application seems somewhat limited, in view of the large number of batteries used for ordinary work and the comparatively small number of bichromate batteries which are used only in small quantities for special purposes.

THE growing frequency of shipwrecks caused by derangement of compasses makes it evident that, old as the instrument is, improvements are still possible in its adaptation to the mariner's purposes. To the natural variation due to the varying influence of terrestrial magnetism there is now added the influence of the iron of ships and their machinery. Of late, however, other unfamiliar influences have been known to cause disturbances of the compass, the most curious being that in which, so the story goes, a person using an iron tonic came in close proximity to the compass and caused a ship to vary considerably in its course on a short run. With much unchallengeable evidence before us it seems that a method of counteracting the influences other than terrestrial is needed, and should be provided. We are aware that the attempt has often been made, and some methods are in vogue at present, but they seem to be unknown to the majority of mariners, or if known, not held in much esteem.

THE versatile M. Hospitalier is continually drawing attention to the dangers awaiting us in the use of testing instruments as usually found. Not long since he pointed out the variations in the indications given by galvanometers supposed to be accurate, and now, as quoted in another column, he shows how a voltmeter may give erroneous indications when employed in connection with an alternating current. He shows that the self-induction of the large number of convolutions is capable of reducing the value indicated by the instrument, especially if the latter contains iron in its construction. It would, therefore, seem that with alternating currents more reliable indications could be obtained from instruments free from self-induction, or in other words, those in which no coils are employed. Captain Cardew's voltmeter should be well adapted for this purpose, and it has already been used with pronounced success. The heating and elongation of a length of platinum wire are not affected in regularity by the alternating current; and as the alternating machine is likely to come into use more and more, it is well to draw attention to a pecularity which might be productive of considerable annoyance.

WHILE the complaints against our own patent office are mostly directed to the delay caused by an insufficient number of examiners, our English cousins raise their voice against the incompetency of their patent office examiners. Referring to a certain case, one correspondent of a contemporary remarks that if a certain application had been made either in America or Germany it would have been rejected on the ground of prior claims. But he does not cease his lament here. In seeking for redress he puts forth the rather startling proposition, that if an action at law were begun against the government, the money received for the patent would have to be refunded, it having been received for protective rights which the government had no power to grant, having already received payment from a prior inventor for the same object. In other words the issuance of two patents on exactly the same subject would make the government liable to suit for obtaining money under false pretenses. It is well known that the English patent office is notoriously lax in the granting of claims, and it was not in this country that the expression arose that a patent is of no value until tested in the courts. While not even a patent office examiner can be supposed to be omniscient, we believe that comparatively few cases could be cited in which our patent office has granted similar claims to different inventors. Hence, though delays under the present conditions are annoying, American inventors should be consoled with the thought that the patent rights granted to them are of value and generally due to a thorough examination.

IN another part of this issue will be found an illustrated article on the Statue of Liberty, giving full details not only with regard to the Statue itself, but also concerning the electric lighting plant with which it has been furnished. We are glad to see the completion of the great work and to remember that, with a great many of our readers, we did something to help M. Bartholdi realize the noble dream of his life. It is not amiss to recall the utterance of M. Laboulaye, that first inspired the young sculptor: "The sentiments which are felt in the United States toward the French are indestructible, and are as honorable to the Americans as to us; and if a monument were built in America as a memorial of its independence, I should think it very natural were it built by united effort, were it the common work of both nations." Neither is it unfit to recall the fact that from the first M. Bartholdi desired to place his statue where it now stands, perfect in its beauty and strength. Perhaps these international courtesies are not so important as they seem, and are forgotten when they should be prized; but it is difficult to picture French guns trained on New York City across the statue that represents the friendship of the two greatest republican nations the world has ever known.

AS the size and power of dynamos continue to increase, the question of the most efficient means of taking the current from the commutator assumes a more important position. So long as we have to deal with currents of moderate intensity and small electromotive force the difficulty encountered is not great, but the numerous instances in which both heavy currents and high electromotive forces are being employed make it advisable to draw attention to a difficulty that will have to be met. Even at present the pressure required upon the commutator to take off heavy currents causes the former to be rapidly worn out, not to speak of the power required to overcome the mechanical friction engendered thereby. In taking off currents of bigh E. M. F. this wearing is still further increased. It may be argued that the difficulty can be met by coupling a number of machines so that the quantity of current or difference of potential may be subdivided between them. This may apply to central stations where room is available for that purpose, but it is hardly possible in the case, for instance, of a machine employed in an isolated plant, or a powerful motor employed in drawing a train of cars. Many attempts have already been made to overcome this evident trouble, but not with any decided success, and the problem of improvement still remains to be solved. For those of an inventive turn of mind, the providing of means for preserving the only perishable part of the dynamo ought to be an inviting subject of investigation.

WHEN the telephone first made its appearance as a practical, every-day working instrument, many were of the opinion that the days of the telegraph were numbered, and that thenceforth communication by word of mouth would leave the telegraph operator, as such, without an occupation. The telephone has now been in successful operation ten years, but so far from falling off, the amount of telegraphic business has increased enormously during that time, and especially so in this country, where the development of the telephone has been greater than in any other. This may be said to have been the case in the period when long-distance telephony was in its infancy. But thanks to the improvements which are steadily going on in this field, we are now enabled to transmit the sound of the human voice intelligibly over hundreds of miles, and instances are on record in which a thousand miles have been exceeded. This brings up afresh the question, whether with such improved systems at our command the telegraph will have to give way to the telephone on long-distance work, as it already has done largely in the case of short distances. According to a German investigator it would appear that while the electrical difficulties have all been removed, those of economy have arisen in their place. In other words, that for long lines over which it would be perfectly practical to hear, the charge which would have to be made in order to realize a fair income on the capital invested would be practically prohibitory. This, we think, may in part be true when applied to very long lines, but within the limits of a few hundred miles we believe that even now the time has come when the telephone can be successfully employed. Certain it is that men of known ability and shrewdness in this country have so much confidence in the practicability of the plan that long lines are gradually extending between cities of importance. The results thus far obtained commercially are quite promising. Of course, due weight must be given to the fact that such lines cannot be operated between points where the traffic promises to be limited in extent, but as stated before we believe that most of our large cities will soon be connected telephonically so that private conversation can be obtained between correspondents in them.

Utilizing the Residual Liquid of Bichromate Batteries.

Being impressed with the fact that the residual liquid of bichromate batteries retains sufficient energy to be used in weaker batteries, M. L. A. W. Desruelles, of Paris, France, has sought to utilize it by an interesting process of converting it into marketable and convenient shape. M. Desruelles starts out with the assumption that the main reason why bichromate solutions lose their power after a time is that their resistance increases, although their chemical properties are not perceptibly modified. Such a liquid would, however, be no serious detriment in batteries used for telegraphic purposes where the external resistances are comparatively high, and hence M. Desruelles proposes to use it for that purpose.

The transportation of the spent liquid of bichromate batteries charged with corrosive substances and acid is not convenient, and hence to solve the question in a practical way the liquid is subjected to a treatment by which its active portions are converted into a solid, and in the following manner.

The residual liquids are mixed in suitable proportions with any inattackable or acid-proof and porous substance capable of forming a paste therewith. The material found to yield the best results is kieselguhr, a diatomaceous earth, or earth composed of the remains of diatoms, and consequently consisting entirely of almost pure silica.

This paste is afterward dried, either by natural evaporation or by vaporizing the water which it contains by the application of heat, and is then divided into cakes, each containing a sufficient quantity of the chemicals to charge a cell or element of a telegraphic battery. When the cakes are dry, they can be very conveniently conveyed to the places where they are required. The materials may be supplied either in the form of cakes or blocks or in the condition of dust or powder, if previously reduced to this latter state. In order to use them they are simply placed in the bottoms of the cells or elements, which are then filled up with pure water. The water dissolves the acids and salts contained in the cakes, and the inattackable and porous material settles at the bottom of the element.

M. Desruelles has also, it may be noted, devised a means of preventing local action in a battery when on open circuit, which consists of a paste or coating called "hydrargérine." The latter is composed of 100 grams of tallow, 25 grams of paraffin and 300 grams of mercury ground or pounded and thoroughly mixed together. Such a coating applied to the surface of the zinc or other soluble electrode is said to protect the latter from corrosion while the circuit is left open, and when the circuit is closed the coating which protects the zinc does not interfere with the action of the battery, for it possesses very little electrical resistance.

On a Thermopile and Galvanometer Combined.

BY PROF. GEORGE FORBES.*

It is my duty to bring before the section some account of an apparatus, a name for which I have not succeeded in fixing upon, but which I have spoken of as a combined thermopile and galvanometer, and that represents accurately what the instrument really is. A thermo-galvanometer may, perhaps, be a term suitable for the instrument, the object of which is to measure the radiation of heat in the manner which has been accomplished by the ordinary thermopile. The special instrument was designed more particularly for use in spectroscopic work; that is to say, to replace what has been generally known as the line thermopile, a thermopile which measures the intensity of light forming a linear image. Some account of the first forms of this instrument was given to the Royal Society last spring; since then, the instrument has been modified with the intention of making it more sensitive. The first apparatus which was constructed was extremely simple, consisting of a very short tube, made of two different metals, one-half of the circular section being of bismuth and the other half of it of antimony. The two edges were filed down, so as to be very thin, and covered with a carbon surface, which absorbed radiation freely. The difference of the intensity of radiation between one junction and the other determined the direction of the electric current which circulated round the composite tube. This circuit naturally had an extremely low electrical resistance, and the compass or magnetic needle, like those employed in Sir William Thomson's galvanometers, was inserted in the tube, and acted directly upon the low-resistance circuit carrying the electric current. It was hoped that by thus lowering the resistance enormously, we should get an increased effect, and the result of experiment seems to support the theoretical conclusion. In the ordinary thermopiles we have a number of junctions, a number of pieces of antimony and bismuth joined together in series, and consequently they offer a much larger resistance than the composite tube of which I have spoken. Moreover, they have the resistance of a galvanometer in the circuit, and in the communication to the Royal Society it was pointed out that one would expect *à priori* that the combination of a galvanometer and a thermopile would be about equal in efficiency to this combination if the galvanometer were made specially of a proper resistance and construction for the thermopile, a thing which is seldom attained in actual practice.

The most complete form of instrument which I showed to the Royal Society consisted of a wedge of antimony and bismuth combined. This is not an exact representation of the wedge, but it is near enough to it to show you the type. You see this is a wedge with a hole passing through close to the narrowest surface. In that hole a magnetized needle and its suspended mirror were placed. The upper part of the wedge consisted of antimony and the lower half of bismuth, and the heat striking the junction of these two determined the electric current which influenced the needle. That apparatus was found to be very sensitive indeed, and is probably as sensitive as any

Fig. 1.—Combined Thermopile and Galvanometer.

arrangement could be for use as a line thermopile. There was one very good point about it—it was very dead beat in its action. This large mass of metal with its low resistance acted as a damper upon the motions of the needle, rendering it exceedingly stable, and causing it to come to rest very rapidly. That was assisted, of course, by my employing in that instrument one of Mr. White, of Glasgow's light mirrors, which are used in Thomson's galvanometer. I cannot conceive anybody using any other mirrors, although in England there seems to be a

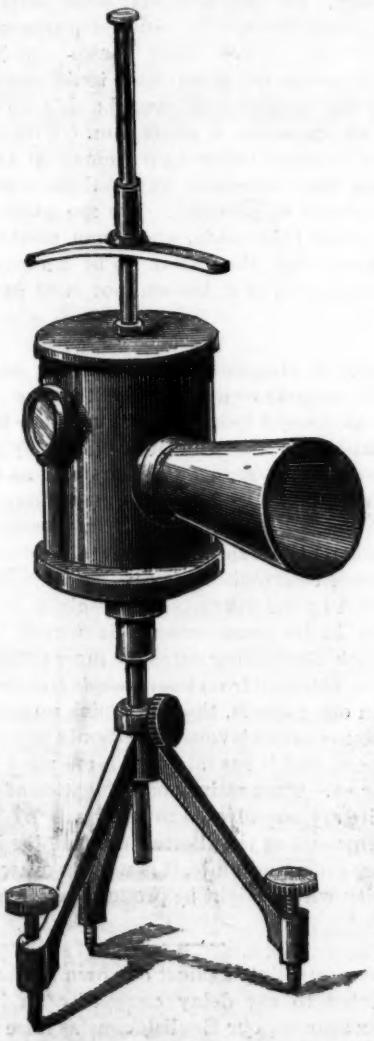


Fig. 2.—Combined Thermopile and Galvanometer.

delight in those heavier mirrors supplied by London makers. Since then I have modified the instrument to make it more sensitive by making it astatic (Fig. 1). Instead of having one set of magnets in the inside circuit only, I have another set outside on the same suspension. The instrument is thus rendered very much more sensitive, but it is not so dead beat. This wedge is inclosed in a brass covering, and it has a cone to reflect the heat on to the surface of these two metals, and it also has a controlling magnet like the ordinary Thomson galvanometers. (Fig. 2). In the present instrument I have put the magnet down as low as possible, to give it very great directive influence, because in this room there is so much tremor that it is difficult to see the action of the apparatus. The heat of my hand placed by the side of the instrument is sufficient to move the spot over a considerable range. This apparatus was made by Messrs. Nalder, and it strikes me as being extremely beautifully made; it is very much more delicate than the apparatus I showed originally.

Prof. Fitzgerald said he would like to know what Prof. Forbes thought as to the relative delicacy of thermopiles and bolometers. Prof. Langley had given an enormous preference to the bolometer as a delicate apparatus for measuring current. Prof. Forbes said he thought his instrument was as delicate as any other; did he include the bolometer?

Prof. Forbes said he agreed with Prof. Langley. He did not think there was the slightest doubt that the bolometer was very much more accurate than any thermopile arrangement. It was simply in comparison with thermopiles that he considered his instrument the most sensitive.

The Rivalry Between the Telegraph and the Telephone.

The question of telephony *vs.* telegraphy has been recently discussed by a well-known German electrician, Dr. Wietlisbach. The chief hindrance to the use of the telephone for long distances is, he points out, of a financial, not of a technical nature. A telephone line 2,000 km. long costs considerably over a million marks. It is still possible to speak very well this distance; but even supposing the line were in constant use day and night, the receipts must be five marks a minute to make it pay. In telephone work, however, the line is in use only a few hours daily; hence a short conversation would cost at least 50 marks ($12). That is, of course, too dear for ordinary traffic. The telegraph works with almost the same speed more than ten times more cheaply. Thus the question as to rivalry between telephone and telegraph finds its settlement. The telephone up to about 500 km. distance (say 310 miles) will more and more displace the telegraph, and find an extension which the telegraph would never reach. But for greater distances the telegraph must keep the upper hand. Thus telephone and telegraph are really not rivals, but fitted to supplement each other.

The Mutual Insurance of Electric Lighting Plants.

The following is from the Boston *Commercial Bulletin*, and gives the latest information on an important and interesting subject:

For more than a year past the electric illuminating companies have been agitating the subject of mutual insurance of their plants. The expert advice of Mr. C. J. H. Woodbury, inspector for the factory mutuals was obtained upon the feasibility of the plan, and it was considered advisable, if enough hazards of a similar character could be obtained.

As the result of a canvass, which was thereupon instituted, it was found that there were 173 electric illuminating companies in the district selected for a beginning. Of this number, 50 companies, having insurable property to the value of $1,084,179, were favorable to the project, and indefinite replies were received from representatives of $200,000 more. As some of the property included above was not desirable for mutual insurance by reason of the hazards imposed on the stations by poor construction of the surrounding buildings or the station itself, it was found that $1,000,000 represented the maximum amount of mutual insurance available as far as shown by the canvass.

These figures were not considered sufficiently large by Mr. Woodbury to warrant the formation of a mutual company at this time. It was hoped by the promoters that at least 150 policies of $10,000 each would be secured with the intent of placing the surplus insurance desired above that amount by any lighting station in other mutuals or in the stock insurance companies.

The project having been given up, efforts were made to see to what extent the factory mutuals would take this class of risks. The result has been that the following five companies have, within sixty days, begun to write electric lighting risks in with their other classes of hazards: Cotton and Woolen Manufacturers' Mutual, Rubber Manufacturers' Mutual, both of Boston; Enterprise Mutual, American Mutual and Mercantile Mutual of Providence.

These companies are all conducted upon the factory mutual plan and are known among the associated companies as "the boot and shoe set," as they have within a year or two begun to write boot and shoe manufacturing risks. The Keystone Mutual, of Philadelphia, while not writing boot and shoe risks, will take electric lighting risks.

Upon inspection by Mr. Woodbury, the electric lighting risks are written at one per cent. for brick structures and one and one-quarter per cent. for frame. The nature of the business requires night watchmen, of course. They are required to have hose and fire pumps and in some cases automatic sprinklers. The latter requirement depends largely upon the contents of the upper floors.

All policies contain the following provision:

"It is understood and agreed that this policy does not cover any direct loss or damage to dynamo machines and their frames, caused to such machine or frame by the generation of an excess of electricity."

The mutual companies did not solicit the business, but now that they are in it they seem disposed to take all good risks offering and think that the business will be profitable.

* Read at the British Association Meeting, Birmingham.

Lighting Bartholdi's Statue of Liberty.

The idea of a memorial of French good-will toward America, and of the friendship that has so long existed between the two nations, owes its origin to the distinguished M. Laboulaye, and was first expressed by him in young M. Bartholdi's hearing, as far back as 1865, at a dinner party given near Paris. It was not until nearly 10 years later, on visiting this country, that M. Bartholdi's conception of the monument to be erected took the shape of a colossal figure of Liberty, and was hailed with enthusiasm. Twelve years ago the French-American Union was formed, having for its object the construction of the statue as a gift to the United States, and efforts were made to raise the necessary funds by subscription. From then until the present hour, when the figure stands in perfect beauty at the entrance to New York harbor, the work has advanced by slow degrees. In 1876 the arm and torch of Liberty were first shown in this country, at the Philadelphia Centennial Exhibition. A couple of years later the French people had raised the requisite sum of $350,000, and by 1880 the entire statue was practically finished. On July 4, 1884, it was handed over to the United States minister in Paris, and it was brought to New York during June, 1885.

Meantime, appropriate measures were taken here to receive the statue in fitting manner. Early in 1876 the American Committee of the Statue of Liberty was formed in New York, and in 1877 Congress accepted the gift of the statue. It being M. Bartholdi's desire to have the statue placed on Bedloe's Island, Congress also set that apart for the purpose. Mr. R. M. Hunt was appointed architect of the pedestal, and Gen. C. P. Stone was appointed engineer-in-chief. At this stage an appeal was made for contributions to the work, and was liberally responded to. But money was still lacking when the New York *World* took the matter in hand in 1885, and raised more than $100,000 wherewith to complete operations on the pedestal. An auxiliary subscription list was opened by THE ELECTRICAL WORLD, which was glad, as a result, to turn over a substantial sum to its daily contemporary. The pedestal cost altogether about $250,000.

The Statue of Liberty is unique in many respects, and would be remarkable if size were its only notable characteristic. Its dimensions are as follows: Height from base to torch, 151 ft. 1 in.; foundation of pedestal to torch, 305 ft. 6 in.; heel to top of head, 111 ft. 6 in.; length of hand, 16 ft. 5 in.; index finger, 8 ft.; circumference at second joint, 7 ft. 6 in.; size of finger nail, 13 by 10 in.; head from chin to cranium, 17 ft. 3 in.; head thickness from ear to ear, 10 ft.; distance across the eye, 2 ft. 6 in.; length of nose, 4 ft. 6 in.; right arm, length, 42 ft.; right arm, greatest thickness, 12 ft.; thickness of waist, 35 ft.; width of mouth, 3 ft.; tablet, length, 23 ft. 7 in.; tablet, width, 13 ft. 7 in.; tablet, thickness, 2 ft.

These bare statistics are inadequate to represent the vast proportions of the figure. It may be added, by way of making comparison, that the torch will accommodate a dozen persons, while nearly fifty more can stand in the head. The statue is built up of sheets of hammered copper 2½ millimetres thick, stiffened by iron bars and copper bands and strengthened throughout by an elaborate system of girders. There are four heavy lightning rods. The statue is built to resist a wind pressure equal to that of a gale blowing no less than 140 miles an hour. The whole is anchored by iron rods. The weight of the figure is about 440,000 pounds, of which the copper constitutes 176,000 pounds.

One of the most interesting questions in connection with the statue has been the manner of lighting it. Almost from the inception it was realized that only electricity would be equal to the task, but just how to apply and utilize the light was not very clear. In THE ELECTRICAL WORLD of May 30, 1885, an illustrated article, giving a full view of the statue, was devoted to the discussion of the subject, and it is only within the last few weeks that any settlement of the point was arrived at, as described below. Next came the question of the system to be used, but that was soon determined by the action of the American Electric Manufacturing Company, of New York, whose President, Mr. E. H. Goff, tendered the whole of the lighting apparatus as a gift. As might be expected, so generous an offer has met with universal commendation as well as with acceptance, and, not unfittingly, the "American" system is now installed and in operation on Bedloe's Island.

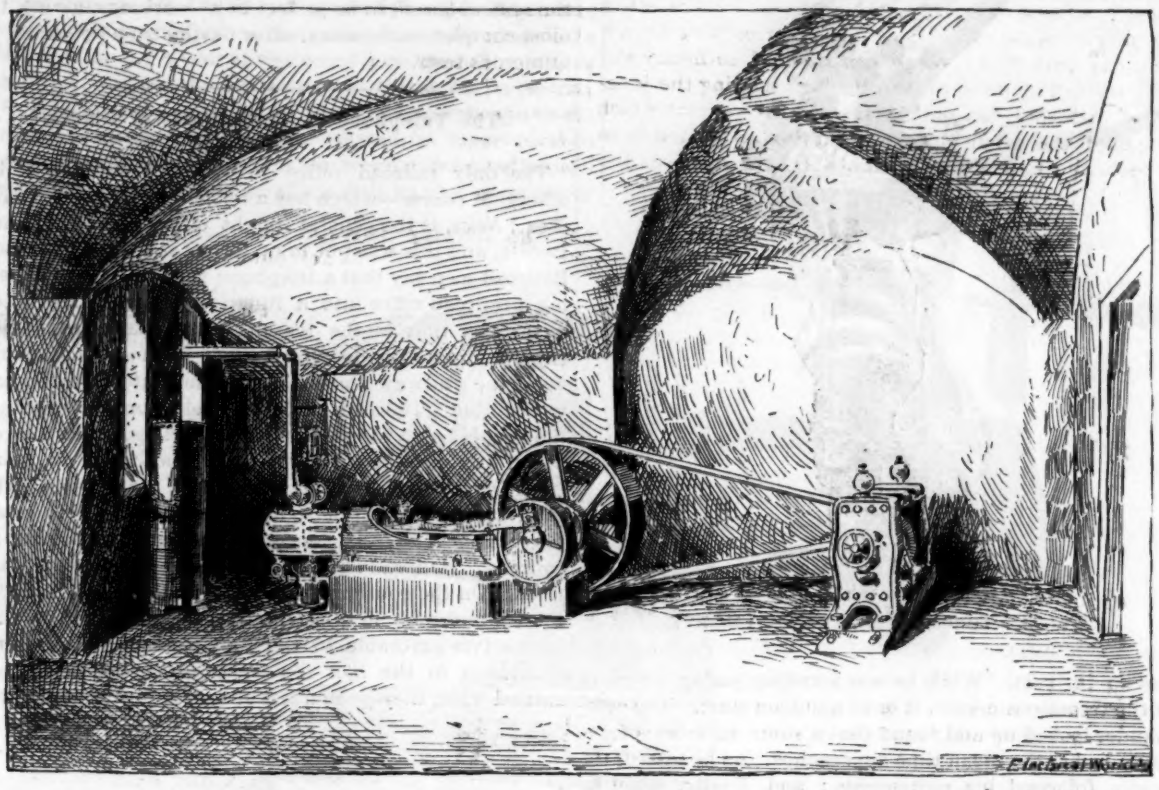


FIG. 1.—LIGHTING PLANT FOR THE STATUE OF LIBERTY—DYNAMO ROOM.

The conditions involved in lighting the Statue of Liberty are of a most unusual nature. Two features have specially to be borne in mind—one, the need of illuminating the figure as a whole, and the other that of using the torch in some way as a beacon light. When the American system was adopted, Mr. James J. Wood, the company's electrician, proposed to light the statue itself by putting four 6,000 candle-power lights on the corners of the pedestal, supported by ornamental cranes. He further proposed to put 10 lights of 6,000 c. p. each above the torch in a circle 6 feet in diameter. These lights were to stand about 4 feet above the torch in a light steel frame. In addition to these, he proposed to place one or two lights inside the torch, which was to be pierced with a few colored glass bull's-eyes so as to give the appearance of streaks of fire or flame at night.

This arrangement would probably, taken altogether, have been most effective. Fearful, however, it appears, of the effect of too great a light, on navigation, the Lighthouse Board decided to place five 6,000 c. p. lights in the angles of Fort Wood, within which the pedestal stands, and to place the remaining ten 6,000 c. p. lights all within the torch. Fig. 3 shows the torch as it appears from the ground. It has 30 holes pierced in it in two rows, the holes being glazed so that the light may shine through. The ten lights inside are placed within a radius of 2 feet 9 in. In some well-informed quarters, the opinion prevails that the great heat in so small a space must affect the working of the lamps, but Lieut. J. Millis, who is carrying out the work, thinks that as the torch will be well ventilated at top and bottom, no trouble is to be apprehended on this score. Fig. 4 shows diagramatically the disposition of the lights within the torch, on the ring that will support them. Fig. 5 is a diagram of Fort Wood, showing the relative position of the boiler shed and dynamo room and of the reflector houses in the points of the star-shaped granite walls. Fig. 6 is a perspective view of one of the reflector houses; the wires run right and left along the top of the walls on ordinary insulators, as seen at either side. Within each house is a special reflector devised for the work by Lieutenant Millis.

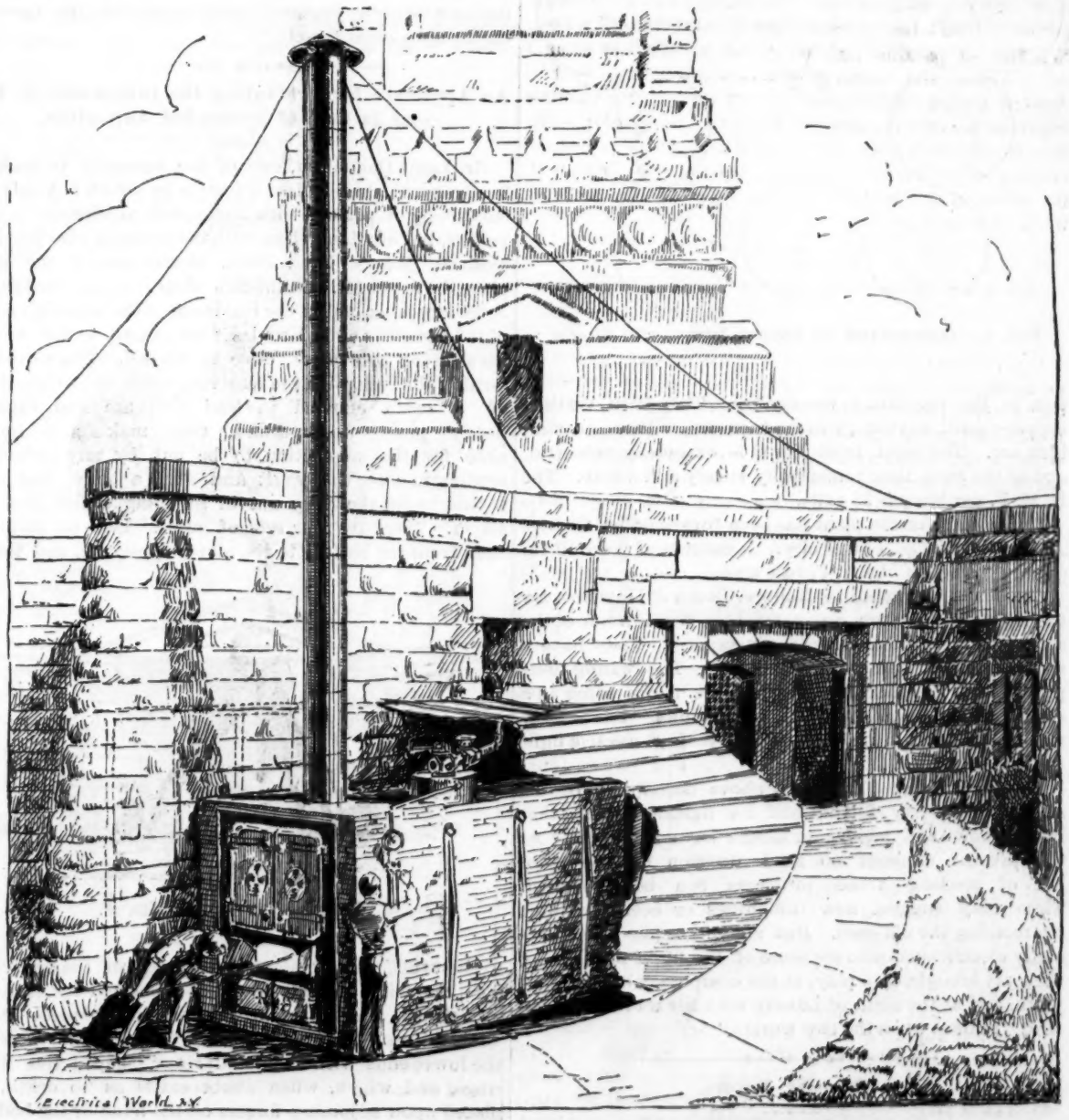


FIG. 2.—LIGHTING PLANT FOR THE STATUE OF LIBERTY—BOILER HOUSE.

As will be observed from Fig. 2, the boiler house is situated at the back of the statue, well out of sight, and yet, from the very nature of its surroundings, about as picturesque as a boiler house can well be. The boiler and

the Armington & Sims engine were furnished by Edward P. Hampson & Co., of this city, and all the work of setting and installing received the constant personal supervision of Mr. William F. Haring, of the firm. The horizontal tubular boiler seen is of 60 h. p., with improved setting, hollow walls, fire-brick in furnace, and bridge wall 9½ by 12. At the present time, the boiler house, occupying, as shown, a corner of the moat, is not all built up, but the dotted lines indicate its front. Steam passes from the boiler by the pipe at the rear, going through the port-hole above, to the engine in the dynamo room, Fig. 1. The engine is a fine 50 h. p. Armington & Sims, with the usual equipment and accessories.

The American dynamo, see Fig. 3, is a beautiful machine, and though practically of no greater finish than the average dynamo made by Mr. Wood, it attracts attention, and deserves praise, for its high mechanical excellence. It embodies, too, all the latest improvements known to the American system, and when tested last week, in the presence of several visitors, including the writer, proved itself capable of self-regulation under the most trying and exceptional circumstances. It ran on a complete short circuit, and with one lamp or without any, but the automatic regulator in use by Mr. Wood gave direct and immediate evidence of its efficiency in the readjustment of the brushes. The machine will support fifteen lamps of 6,000 c. p., at 875 revolutions, with 30 ampères and an E. M. F. of 700 volts. The resistance of the machine is 3½ ohms. It weighs 3,700 lbs. There are 240 lbs. of No. 9 copper wire on the armature and 640 lbs. No. 5 B. & S. copper wire on the field magnets. The total electrical horse-power in circuit is 32 h. p.; the horse-power required at the dynamo pulley is 35 h. p.; the electrical horse-power per lamp is 1.53; and the electrical efficiency of the machine is 91.5 per cent.

The duplex lamps used are of the general "American" type, but have for use in the torch a reinforced insula-

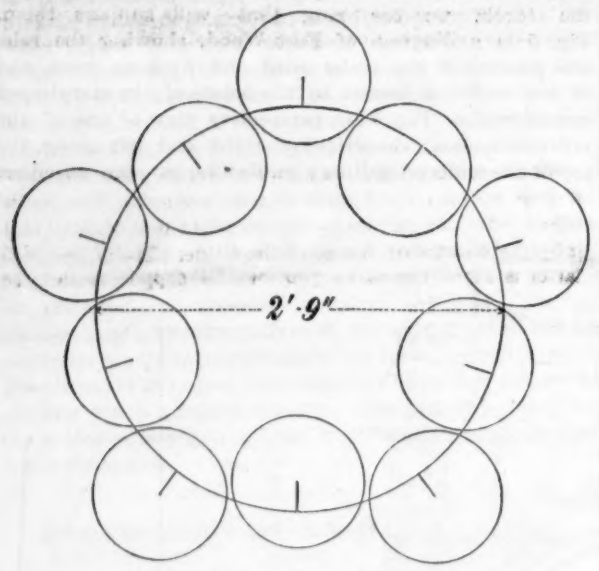


Fig. 4.—Disposition of Lights Inside the Torch.

tion in the regulating mechanism. They burn Wallace copper-coated carbons, ½-inch diameter, with a quarter-inch arc. The light from them is extremely powerful, and at the same time remarkably steady and white. The E. M. F. per lamp is 38 volts.

The belting for the plant has been furnished by Charles A. Schieren & Co., of this city. It consists of two 10 in. double "Electric" belts, 47 feet long.

The leads, furnished by Holmes, Booth & Haydens, for the lights in the torch are carried up the interior of the statue and fastened wherever necessary. They have a specially thick and tough insulation. The wiring itself presents no peculiar features, all the lamps being in a straight plain circuit from the one machine. The outside wiring has been done with ordinary No. 5 electric light wire.

It will be gathered from the above description of the statue on Liberty Island and its lighting plant, that many new and serious problems have been met. At the present moment no final decision on the manner of meeting those problems can be expressed. Time may suggest new difficulties or better ways of overcoming the old ones. But all will rejoice, and especially electricians, who see some of the finest products of their art brought into play, at the completion of the great work, and at the sight of Liberty with her torch of living fire, "radiant upon the two worlds."

Compass Errors.

We have lately heard of several remarkable stories as to deviation of the compass, but it would be difficult to beat the following, which we take from the Toronto *Mail*: "A strange phase of the mystery of the compass was made manifest on the occasion of a recent cruise of the 'Cygnet.' The yacht left Toronto for a run across the lake to Niagara. Everything was fair and smiling. A large party of jolly people were on board, who enjoyed the trip greatly. It was found when they came within hail of land that they were seven miles out of their course, having come out opposite Wilson, N. Y. The commander was greatly troubled. It was decidedly a reflection on his seamanship, and he was exceedingly annoyed. He regarded the compass suspiciously, and carefully examined its surroundings, but could discover nothing that would account for any vaga-

Fig. 3.—Torch of Statue of Liberty.

ries on its part. While he was standing gazing gloomily at the tremulous needle, it gave a sudden start. The commander looked up and found that a stout member of the party had in the mean time approached. As he passed, the needle followed his movements; and finally, when he stopped at the bow, the needle pointed straight at him. A series of experiments were then instituted, and it was found, when the stout gentleman was near, that the pointer followed him. He admitted that for some weeks past he had been indulging in the wild delights of an iron tonic, and he was afraid that his system had become permeated with the metal. This explanation was accepted by all, and the secretary was requested to communicate the facts to the Philosophical Society."

An Appliance for Preventing the Interment of Persons in Case of Suspended Animation.

Mr. Louis Duennisch, one of the cemetery trustees at Sandusky, O., has devised a system by which not only the entombing of persons with suspended animation is prevented, but any tampering with the bodies is also provided against. Messrs. Grah Bros., electricians of the same place, have put Mr. Duennisch's ideas into practical shape. A battery is located in the residence of the superintendent of the cemetery and alarm bells are affixed to the wall of his sleeping apartment, close to his bed. The wires connecting the bells with the receiving vault are in the form of a cable encased in lead, and are laid through heavy pipes underground, thus making it impossible for the connection to be cut by any person intending to enter the vault and steal a body, and if it should be cut the very act of so doing would give the alarm. There are four sets of wires. Two of them extend from the battery to the alarm apparatus, and thence

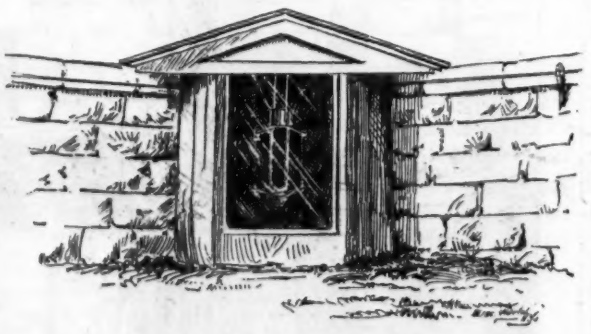


Fig. 6.—Reflector House.

to the vault, running along the ceilings of the two corridors, one wire on each side, and connected by electrical conductors, which hang from a long centre-piece in the vault ceiling. These latter conductors are all provided at the lower ends with insulated rings, shaped like finger rings, and which, when doubt exists as to death, are placed upon adjoining fingers on the hand of the body in the coffin, and, in case of the slightest movement of the fingers, an electric circuit is thereby formed, and the alarm bell in the bed-room of the superintendent rings violently and continuously. There is an indicator for each corridor of the vault, so that the superintendent is enabled to tell instantly the location of the coffin from which the alarm proceeds.

The burglar alarm, too, is a most ingenious contrivance. An attempt to open the door of the vault, or to cut throughthe filigree iron work that forms the panels, or to break the glass in the door, instantly establishes an electric circuit, and the superintendent is notified by the bell that a burglar is at work in the vault. The fourth wire in this most ingenious system is connected with an indicator near the bottom and a button near the top of the elevator shaft in the vault, and is used in giving signals for the lowering of bodies from the chapel to the vault at certain intervals in the religious services. Taken as a whole, the system is said to be perfect in its workings, giving the most complete satisfaction after having been subjected to numerous tests.

The Telephone in Texas Railway Offices.

The only railroad office in the city—barring ticket offices, of course—which has a telephone, says the Dallas (Tex.) *News*, is the general freight office of the Missouri Pacific, and this was put in no longer ago than yesterday. Railroad men say that a telephone is capable of converting a railroad office into a lunatic asylum inside of two days, and that is the reason that instrument doesn't enjoy a larger popularity and is not in more general use with the railway fraternity. Immediately it becomes known that a railroad office has telephonic connection, the people begin to ask when this arrives, when that departs, what are the freight rates to and from all points from Dan to Beersheba, inclusive, and for various other information, amounting to more than could be condensed into an encyclopædia, concerning the details of running a railroad. Railroad men do not object to answering questions. On the contrary, their chief delight lies in clearing up conundrums in their line of business, and making themselves agreeable to the public generally. But the trouble is in the fact that most people get excited and rattled when they go in quest of railroad information, and

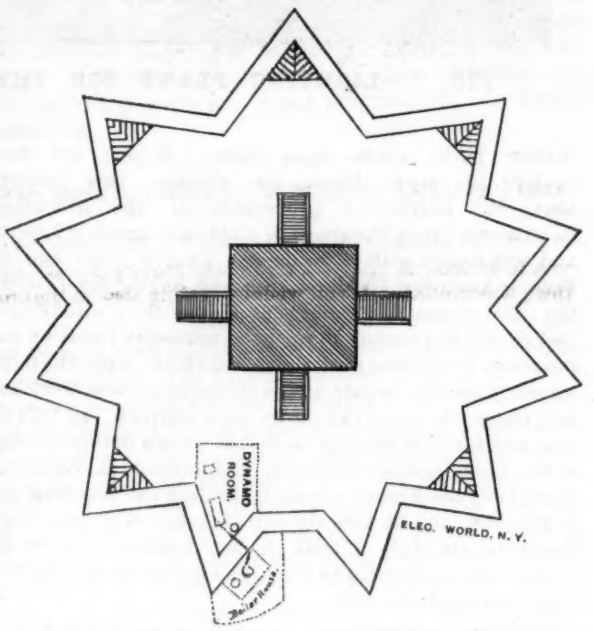


Fig. 5.—Plan View of Statue.

it seems impossible for them to correctly catch what is told to them over a telephone, and then, if they do catch the figures, they have misgivings as to their accuracy, and, ten to one, will go to the office to verify them. They do not believe their ears. They want to see if the official will tell them the same to their face, and to judge by the expression of his countenance whether or not he is telling the truth. In a word, seeing is believing with them. For these and various other reasons, a telephone is an eye, or rather an ear, sore to the average railroad man.

A New Application of the Photophone.

M. Léon Esquille has found it possible to employ photography and electricity together, for the purpose of recording and reproducing speech in a more direct manner than has hitherto been done. M. Esquille's method consists in speaking in the first instance to a photophone transmitter. Our readers will remember that this is merely a diaphragm with a highly polished surface from which a ray of light is reflected. The record of this speech is then obtained by simply photographing the ray of light upon a traveling band of sensitized paper. After having been developed, the articulation may be reproduced by projecting the image of the trace by means of an electric arc or oxyhydrogen light upon a selenium receiver, preferably one of the form due to M. Mercadier. The speech is then heard through the telephone in the usual manner.

Telephony Extraordinary.—We recently gave an account of some remarkable experiments, which are alleged to have proved that a person in a mesmeric trance is capable of interpreting a telephonic message by mere contact with the line wire. We have now the authority of the *Journal d'Hygiène* for the statement that a young lady, employed in a telephone exchange, who happened to be in a highly nervous condition, found that she was able to understand a conversation without lifting the receiver to her ears, by merely holding it in her hand.

Schlesinger's Electric Street Railway System.

For several months past an electric railway has been in operation on Ridge avenue, Philadelphia, running for a distance of about two miles, and having one terminus at the Laurel Hill Cemetery. This line was constructed by the Union Electric Company, under the direction of Mr. H. M. Schlesinger, and is in daily successful operation.

In order to avoid overhead conductors and also the use of the rails as conductors, the mains have been placed in a conduit having a slot at the top for a lever which leads the current from the conductors to the motor on the car. In designing the conduit, it was found inadvisable to cut through the cross-ties of the railroad, as these form in most cases the foundation of the track. Practical experience has proved that a small conduit having good sewer connections answers all purposes. Fig. 1 shows a section of the conduit and road-bed. The main conduit is only 9 in. deep by 5½ in. wide. It is built in sections of from 15 feet to 20 feet, of heavy channel iron resting on the cross-ties; substantial cast-iron wedges, resting also on the cross-ties, hold the two sides of the conduit at the proper distance from each other at the bottom and leave an opening ⅝ inch in width between the lower flanges. To the sides of the channel iron, at proper distances, small angle irons are riveted to keep the slot of the conduit at the proper size. Braces are attached to the angle irons which pass through either cross-tie or stringer and are provided with nuts by means of which they can be tightened or slackened at will. An auxiliary conduit is put down below the cross-ties, built either of wood or cement. At convenient places this connects with large manholes at the side of the track, and these again communicate with the sewers. Water and small particles of dirt fall through the opening made by the wedges between the channel-iron into this lower trough and pass from them to the manholes and sewers. But to prevent any accumulation in the upper conduit, this opening is at proper intervals increased to 5 inches by cutting away part of the lower flanges of the channel iron.

The greatest difficulty experienced with underground conductors is to protect the insulation of the conductors from water and dirt. To accomplish this in the conduit of the Union Electric Company, an angle iron is riveted to the top flange of the channel iron in such a manner that one of its flanges, pointing downward parallel to the main side of the channel iron, forms one side of the slot. In the inverted trough formed in this manner the conductors are fastened, so that the contact side, *i. e.*, the side on which the pieces rub, is the lower side. The conductors are much narrower than the trough, so that contact with its sides is impossible. Dirt or water coming in through the slot will, therefore, also fall to the bottom of the conduit without interfering with the insulation.

The conductors are made shorter than the sections, and the trough is closed at the ends of the sections by means of a block of wood or other insulation, the lower side of which is in the same horizontal plane with the lower side of the conductors. These latter end within about ¼ to ½ inch of these blocks. In this manner the insulation is protected from any dirt or water coming in between the sections.

All sections are made exactly the same size, so that if one is damaged it can easily and quickly be replaced by another.

The conductor itself is a copper bar, to the lower surface of which a small angle iron is fastened. The contact pieces rub along the iron and are prevented from leaving it by the downward flange of the angle. The object of the latter is furthermore to protect the copper from wear. The connections between the conductors of two adjacent sections are made in boxes outside the conduit. At proper intervals, the top of the conduit is made removable, giving access to the inside. These traps are also put at every place where a connection is made with a manhole. As in opening these traps, the top plates are often handled roughly and thrown in the dirt, they are not provided with conductors, but in place thereof wood is fastened

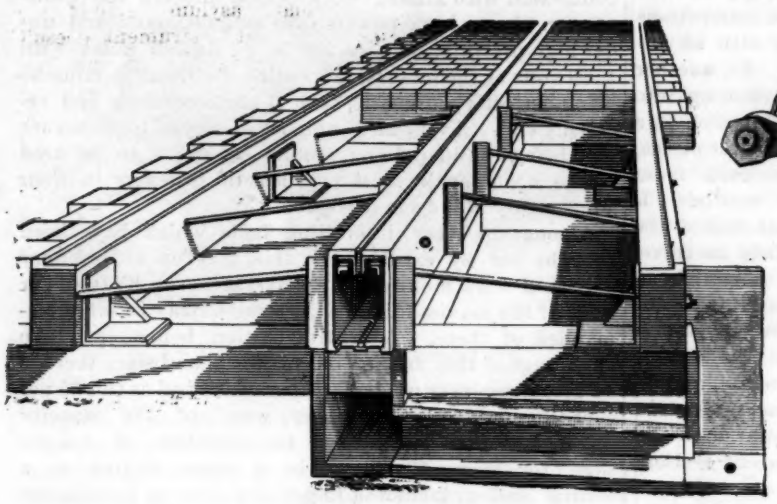


FIG. 1.

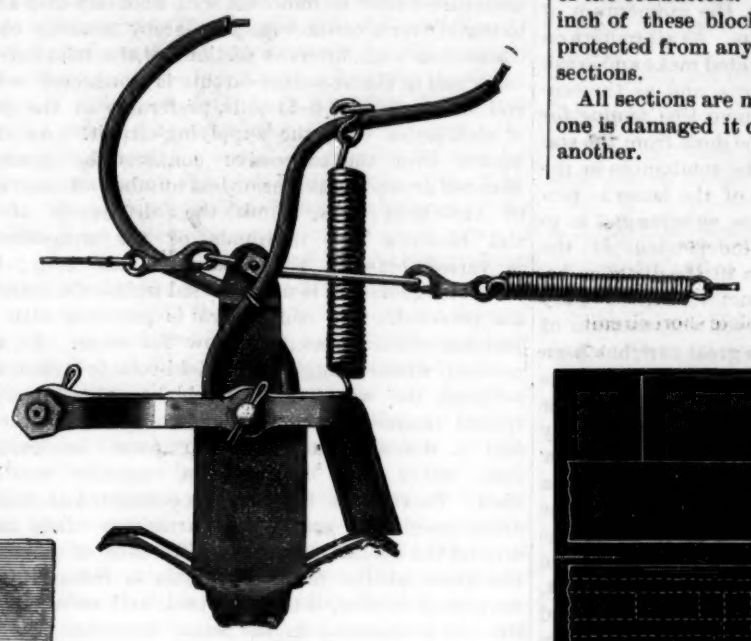


FIG. 3.

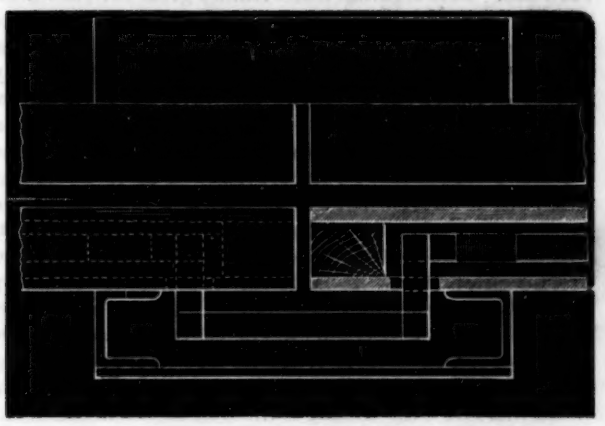


FIG. 2.

THE SCHLESINGER ELECTRIC STREET RAILWAY SYSTEM.

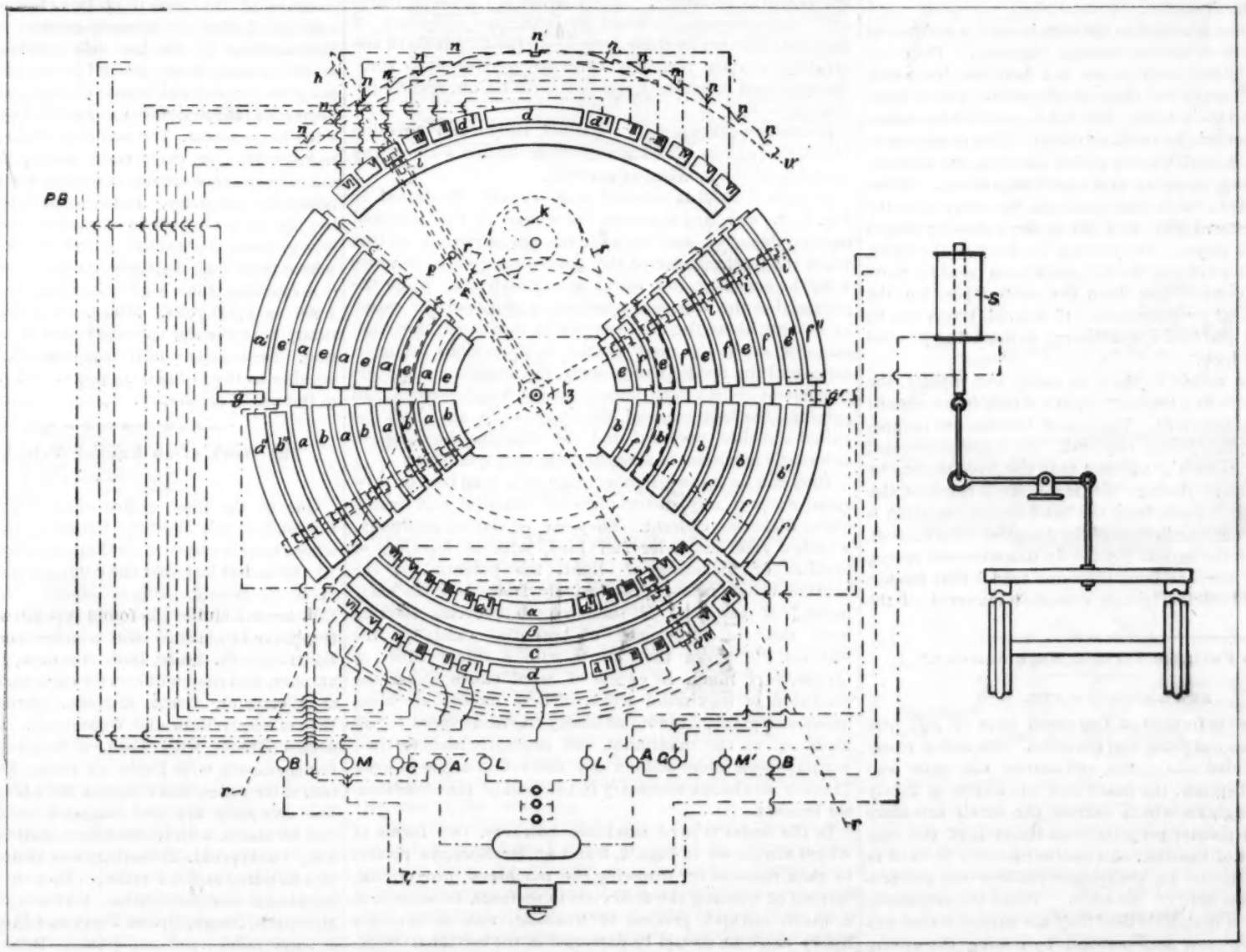


FIG. 4.—DIAGRAM OF SWITCH CONNECTIONS OF CAR—SCHLESINGER SYSTEM.

to them. The current is carried round them through insulated wires. This also prevents interruption of traffic in case of the opening of a manhole.

All connections between the conductors of adjacent sections are easily accessible, so that in case of damage to one section this can easily, and without interfering with the conduit, be cut out of the circuit and the current taken round it by means of insulated wire. Fig. 2 is a plan view showing the connection between two sections. As the latter are only 20 feet long at the utmost, the momentum of the car will easily carry it over the gap. As all motors on the cars are in multiple arc, no complicated make and break appliances are required in the conduits, and as the conductors on either side form one continuous line, testing for insulation and continuity can easily be done from the station. To convey the current from the conductors in the conduit to the motor on the car, each of the latter is provided with specially constructed frames, so arranged as to make the contact pieces perfectly independent of the oscillations of the car or any variation in the distance between the body of the car and conductors, caused either by varying loads on the former or uneven construction of road-bed. In designing these frames great care has been taken to combine simplicity with strength, the vital parts being well protected by strong cast-iron or phosphor bronze frames. This frame, shown in Fig. 3, is secured by means of a bolt to the car in such a manner as to allow perfectly free motion in a vertical, and sufficient in a horizontal, plane. Through a fork in this frame the phosphor bronze casting passes, fastened to it by means of a bolt, so as to swing freely in a vertical plane and to have enough side-play. This casting passes into the slot, and carries two steel springs well insulated from it and from each other. A strong spiral spring, which takes up all the irregularities in the motion of the car, presses the springs against the conductors. To furthermore insure good contact, the phosphor-bronze casting is connected by springs and wire ropes to a lever on the front platform. With this lever, the casting is tilted in such a manner that in going forward the front parts of the contact-springs, and in going backward the back parts, are moved away from the conductors. Two such collectors are supplied to each car, one having the cast-iron finger pointing forward, the other backward. On the road now running in Philadelphia it has happened several times that large paving stones were placed intentionally at night on the conduit, but they were invariably thrown to one side by the frames without doing the slightest damage. The steel springs used as contact pieces give a very steady and good contact, as shown by the ammeter.

The motors are attached to the cars in such a manner as not to interfere with the seating capacity. They are placed beneath the body of the car between the axles, and specially constructed chains transmit the power from the armature to the wheels. The car is operated by means of a single lever on the front platform. This is shown in outline in Fig. 4, which gives a plan showing the connections for starting, stopping and speed regulating. When the lever stands in the middle position, the current to the armature is interrupted, and the motor naturally stands still or gives no power. On moving the lever to the right, the car runs forward; to the left, backward; and by moving the lever more or less from the central position, the speed is increased or decreased. If desired, levers can be placed on both platforms, the one not in use being secured by means of a lock.

To allow the motor to start up easily and rapidly, the field magnets are in a separate circuit which is not opened when the car stands still. The motor brushes are tangential, one pair only being required. They are connected with the lever in such a manner that the same motion by which the current through the armature is reversed also sets the brushes. Aside from the hand brakes, each car is provided with electric brakes of the simplest construction. The interior of the cars is lighted by incandescent lamps, deriving their current from the same source that propels the motor; and electric gongs complete the outfit of the car.

Miller's Portable Torsion Magnetometer.*

BY PROFESSOR BLYTH.

The armature is formed of five small bars *of soft iron* 5 mm. long and weighing one gramme. The index wheel has its rim divided into $\frac{1}{10}$ths, and carries the outer end of a flat spiral spring, the inner end of which is firmly fixed to the long axis which carries the small armature bars. A fixed pointer projects from the ends of the case across the edge of the disc, and another pointer is fixed to the armature axis. In the normal position the pointers both point to the zero of the scale. When the armatures are placed in a magnetic field they are turned round and brought back to their zero position by coiling the spring through a definite angle depending upon the strength of the field. A constant is determined for the instrument by experiments in a field of known strength, or, if necessary, it can be empirically guaranteed. It is hoped that the instrument will be found of service to makers of dynamos for finding the strength of the field in various parts, and also for finding the best forms of pole pieces. There is also exhibited a form of small attraction magnetometer.

* Paper read before the British Association at Birmingham.

The Sprague System of Electric Motors.

(*Concluded.*)

One of Mr. Sprague's methods for varying the speed and power is to wind the field magnets with a series of coils of different cross section and resistance. These coils are all in series with each other, and the bights of the coils are brought to a commutator.

In the simplest form of this motor, one end of the armature-circuit is connected with a contact-arm arranged to travel over a contact-range, thereby making electrical connection with different sections of the field-coils. The other end of the armature-circuit is connected with one end of the series of field-coils, preferably at the junction of such series with the supplying-circuit. As the arm moves over the successive contacts the armature is shunted around a greater or less number of the sections of the field-coils, and the difference of potential between the terminals of the armature-circuit is varied between the maximum and zero; but in this arrangement it is not reversed unless the connections are reversed. The contact-arm is provided with an adjustable contact-piece, to allow for wear. In another method, where a single set of field-coils is broken up into sections, the wires from the bights are connected in a special manner to a circular range of contact-pieces, and a double arm, the two parts insulated from each other and bearing on opposite sections, is used. To each of the arms is connected an end of the armature-circuit, and as the arms are made to travel around the contact-range the difference of potentials at the arms or the brush terminals is reduced from the maximum to zero, is then reversed, and increases; and if the arms continue in the same direction another half revolution it is diminished to zero, changed again, and increased to the original maximum. The connections of the field sections are made thus: the first and last to single and opposite blocks of the range; the next adjacent sections have double connections to the next adjacent blocks on either side of the first ones connected, the next sections to the next adjacent pairs of blocks on either side, and so on till the blocks meet. In a third method two series of field-coil sections are used, and the bights connected to two ranges of contact-pieces arranged in one or two circular or partly circular sets. Here, also, two arms insulated from each other are used, and the two arms are connected to the two terminals of the armature-circuit—that is, the armature-circuit becomes what corresponds to the galvanometer-circuit in the Wheatstone bridge. As the arms are made to travel over the successive contact surfaces, the difference of potential existing at these arms or at the terminals of the armature-circuit decreases from the maximum to zero, changes, and increases again to the maximum reverse potential.

In this last arrangement the speed, torque and direction of rotation can be varied as rapidly as desired without any sparking at the moment of reversal.

In types 1 and 8 as referred to above and illustrated in Fig. 1, the standard machines are wound in the sectional method described and in addition are arranged so that when the motor is started the governing coil is in series with the armature and works accumulatively, while the potential at the armature terminals is progressively raised by moving along the field sections by means of the commutator at the top, part of the field sections being in series and the rest in shunt with the armature; this arrangement gives a very strong rotary torque—when full potential has been reached, the coarse coils are short circuited and then reversed and the machine becomes an automatic machine, having the following qualities:

They can be thrown into a circuit at a dead rest, or slow speed without any disturbance of potential and consequent flickering of light. They can be started gradually, whether free or under full load, without burning of brushes or flickering of light, the potential at the brushes being raised progressively from zero to maximum. If the load is such as to prevent starting until the full difference of potential exists at the brushes, the motor then starts with a rotary effort, or torque, very much in excess of what exists under the condition of maximum work. These motors are absolutely automatic, running at nearly the same speed for all loads up to the maximum, and promptly recover their normal speed under sudden and marked changes in load. There is no change necessary in the lead of the commutator brushes.

In the larger type of machines, however, two forms of which are shown in Figs. 2, 3 and 4,* Mr. Sprague prefers to use a rheostat for throwing the machines into circuit, instead of winding the field coils in sections, because it is a much cheaper process of working, and as in case a heavy machine should be damaged in the sectional winding, it would be far more costly to make repairs to it than in the case where a rheostat is used. Of course this rheostat carries no current, except at the moment of starting.

These motors will lower a varying weight at the same speed that they will pick it up, and with the same freedom from sparking.

In another form, a variable speed machine, such as is now in use in the Western Union operating room, the rheostat is of peculiar construction. By a single movement of the switch the machine is thrown into circuit with a very strong field, the potential at the armature terminals is gradually raised, and after full potential has been reached a resistance is then thrown into the field magnet, and the field thus weakened so that the speed of the machine is increased. This method of working allows of the finest gradations of speed.

Another machine which is just being brought out for use on constant potential circuits permits of nine or ten variations of speed from a single switch movement without the use of any external rheostat, and another type permits of a like variation of speed and entire reversal of movement, also with the single switch. This latter type is designed for operation on street cars.

For all ordinary work motors are built for constant potential circuits of about 100 volts. But the demand has come for 220 volt machines to go on the Edison three-wire circuits. Before long the Sprague Company expect to undertake some special cases of transmission of power in connection with mining work which involve the transmission of very large powers over long distances and under high pressure, such as 200 h. p. sixteen miles with 1,000 volts at the motors, the entire electrical conditions being perfectly automatic, both at the generating and receiving end. A very large number of special problems are now being considered and motors are going to be used where none but the most enthusiastic believers in their adaptability will deem it possible.

Among the very interesting facts which have been brought out by experience is this, that on all ordinary classes of work motors do not average over 35 to 40 per cent. of the maximum capacity which may be safely demanded of them. A central station hence can take advantage of this falling off of work, and since there is an actual recovery of about 65 per cent., and as this 65 per cent. is only about 40 per cent. of the capacity of the motors which are in operation, it follows that, for every 100 h. p. in a steam engine at a central station, including 10 per cent. loss on distribution where the work is widely distributed, about 170 h. p. can actually be contracted for. The future of the transmission of power is a bright one. There are ignorance and prejudice and other adverse circumstances to be contended against. These always enter as important factors against the success of business in any locality; but there is no class of work, even when we reckon in the larger powers, which, when dealt with on the broad plane of a central station, cannot be dealt with in the same way as the smaller powers. As a marked instance of the growth of this class of work it may be mentioned that 23 Sprague motors have been sent to Boston alone in the last few weeks. In another place several motors were ordered before the parent light company knew a local company had been formed, and in Springfield the first motor ordered for a new power station is a ten horse motor. The public is gradually being educated to know that in every place where there is the use for machinery there are opportunities for the transmission of power by electricity. In the western territory where mining operations have to be carried on under the most expensive systems of obtaining power the field is unlimited, but where these long distances and large powers are to be used it is essential that high potentials be used, as high as a 1,000 or 2,000 volts. Mines, too, offer a fruitful opportunity both for the transportation of coal and for ventilation. In short the universal demand for an efficient and reliable method of getting power will find its best answer in the use of electricity.

* Electrical World, Oct. 16 and 23, 1886.

The Work of an English Telephone Company.

One of the most active of the telephone companies in England is the Western Counties and South Wales, of whose work we have more than once made passing mention. At the end of last year the company named had exchanges open in Bristol, Clifton, Cardiff, Newport, Plymouth, Devonport, Mutley, Torquay and Portsmouth; since then they have established their telephone exchange system at Bournemouth, Poole, Bath, Swansea, Llanelly and Southampton, and they will shortly open their exchange system at Worcester, Great Malvern, Shrewsbury, Hereford, Weston-super-Mare and Weymouth. They have also connected Bristol with Bath, a distance of twelve miles; Bournemouth with Poole, six miles; Torquay with Paignton, three miles; and Swansea with Llanelly, twelve miles. The company are also engaged in connecting Bristol and Swansea, with intermediate stations at Newport, Cardiff, Pontypridd, Treherbert and Briton Ferry, a distance of a hundred and six miles. They are also establishing telephonic communication between Swansea, Landore, Morriston, Neath, Briton Ferry and Port Talbot, a distance of forty miles; and are joining Bristol and Gloucester, Pontypridd and Merthyr via Aberdare, Newport and Pontypool, and Worcester and Great Malvern, and it is expected that all these extensions will be in operation before the end of the year. The company also contemplate connecting Bristol with London, and also Portsmouth, Southampton, Bournemouth and Weymouth with London. Here is such activity as to warrant the belief that, being in the West of England, the company, by some inductive action, has become filled with not a little American energy.

Some New Lecture Experiments.

Under the title of "New Lecture Experiments upon the Transformation of Electric Energy," *l'Electricien* describes several interesting and instructive experiments with induction coils. To illustrate some of the effects of self-induction the following arrangements are suggested.

Self-Induction.—Fig. 1 shows the disposition of the apparatus. A battery *P*, the electromotive force of which is insufficient to supply directly an incandescence lamp *L*, but is able to give under the conditions of maximum power a number of watts greater than that which the lamp requires to act normally, is connected to the primary of a Ruhmkorff coil. The lamp is placed in derivation at the extremities of the primary. When the coil is set in action the lamp becomes incandescent, because at the

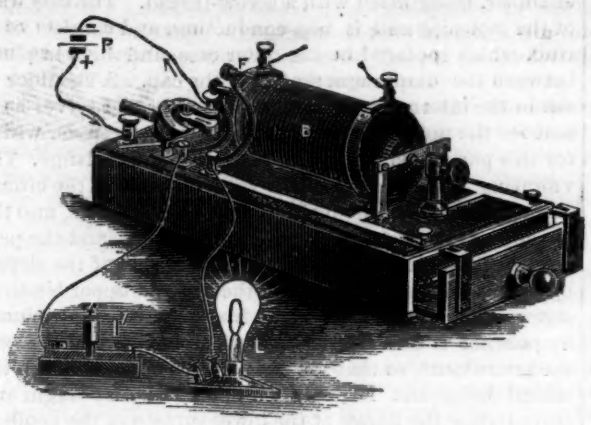


Fig. 1.—New Lecture Experiments.

moment when the circuit is opened by the break, the extra current (the electromotive force of which is very high) is sufficiently intense to produce this illumination. The interposition of the lamp diminishes the breaking spark at the vibrator, which becomes stronger if the lamp is suppressed. The effect of the condenser is also shown by the lamp, which becomes less brilliant if the condenser is withdrawn.

Mutual Induction.—Two ordinary Ruhmkorff coils, B_1 and B_2, Fig. 2, are used, and the well-known apparatus *B*, employed in lectures to demonstrate the general laws of induction.

First Experiment.—There are arranged in circuit the battery *P*, the primary of the coil B_1, and the primary circuit of the apparatus for demonstration. The coil B_1 serves to produce an interrupted current in *B*. The lamp *L*, connected to the secondary coil of *B*, is illuminated immediately. We may diminish the brilliancy of the lamp by withdrawing more or less the iron core *F*, which decreases the co-efficient of mutual induction of the two circuits of the apparatus.

Second Experiment.—The coil B_1, being arranged as in the first experiment, the ends of the secondary of B_1 are connected to the ends of the secondary of B_2, which thus

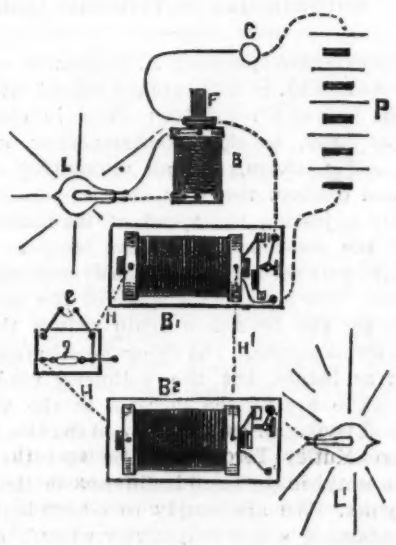


Fig. 2.—New Lecture Experiments.

becomes an inducing circuit, and introducing into this circuit an experimental table. We adjust the vibrator of B_2, and connect a lamp *L'* to the two ends of the primary of B_2. Under these conditions the lamp *L'* burns with a brilliancy which can be regulated at will by acting upon the length of the spark which plays between two points arranged at *e* upon the experimental table, or by introducing a Geissler tube upon this table. The simultaneous illumination of the tube and of the incandescent lamp shows at once the two inverse transformations of the current furnished by the battery *P*. The maximum illumination of *L'* is obtained by making the space *e* null and withdrawing the iron core *F* from the apparatus *B*; in this case *L* becomes dim.

The inverse effect is produced by replacing *F* and withdrawing the movable core of B_2.

To succeed, there are required six accumulators or six bichromate elements, and lamps of about 20 volts. Numerous variations may be introduced into these experiments, which show so strikingly the reciprocal effects of self-induction and the mutual induction of circuits traversed by periodic currents.

A New Form of Motor.

It has been the rule in the construction of electric generators or motors to so adjust the armature with respect to the field-magnets that in revolving, the bobbins would pass transversely through the field of force adjacent to one of the poles and then transversely through the field of force adjacent to the other pole. Recently, however, Mr. Frank E. Fisher, of the Detroit Electrical Works, has devised and patented a modification of this by locating the plane of revolution of the armature parallel to and between two planes, each of which contains one of the field-magnets. The opposite ends of these field-magnets are then united by a pole-piece extending from one across to the other in such manner that instead of revolving through the field adjacent to the poles respectively the armature is caused to revolve within the plane containing the poles of the machine, so that the poles are opposite the periphery of the armature and diametrically opposite each other.

Our illustrations, Figs. 1 and 2, show the new design in elevation and in plan, and are so clear that no further description is deemed necessary. According to Mr. Fisher, a machine, whether motor or dynamo, constructed in this manner operates with very much less resistance, and consequently delivers a greater effective force with the same impelling current. He attributes this increased efficiency to the fact that the construction is such that the armature revolves diametrically between and in the plane containing the poles, instead of being

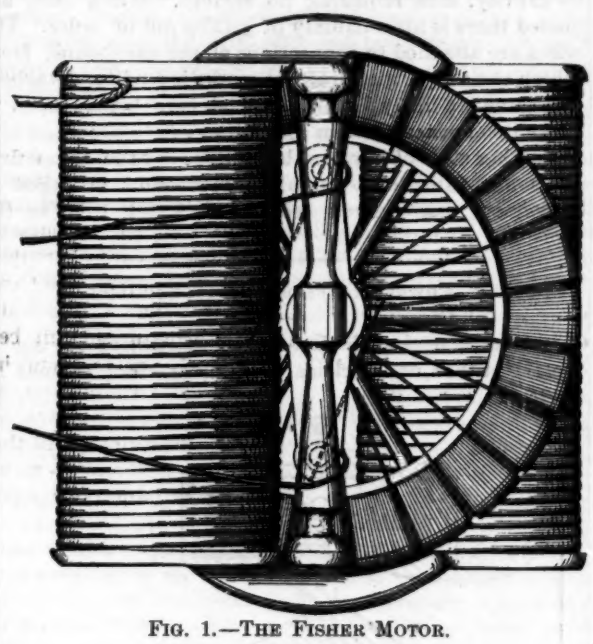


Fig. 1.—The Fisher Motor.

obliged to cut through the plane transversely. Mr. Fisher, who has of late done considerable studying on the motor question, is also of the opinion that a beneficial effect in lessening the resistance to the revolution of the armature is obtained by the location of the armature with respect to the poles, so that its bobbins shall have a motion first transversely from end to end of one magnet in a direction across or through the planes of its successive convolutions of wire, and then in like manner from end to end of the other field-magnet.

The Underground Wire Problem.

Writing under this heading in the *Engineering News*, Mr. S. S. Wheeler describes some of the obstacles met with in the burying of wires, and his sensible views are so well expressed that we venture to reproduce part of the article.

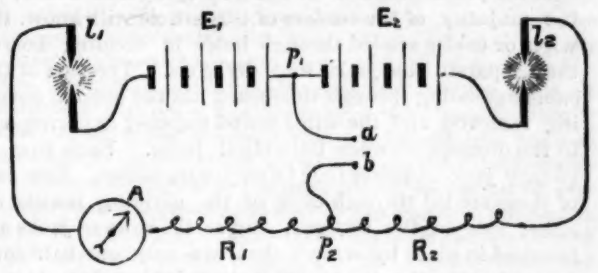
One of the difficulties, says Mr. Wheeler, is leakage. This is overcome by good insulation. Bad insulation of a wire corresponds to the porosity of an earthern pipe, which has to convey a fluid a long distance efficiently. Insulations are not absolute; consequently, the longer the line or the greater the pressure, the better the insulation required, or the greater the loss of current before reaching the end of the line.

The other difficulty is induction. This is a curious manifestation of electrical action, by which the signals which are sent through a wire are more or less faintly reproduced in a neighboring wire, but this is not due at all to leakage, and there is no direct passage of current to or from either wire. It is sometimes popularly described as a sympathetic irritation. One of the most familiar instances of it is the buzzing heard in telephones. In other forms, under the names of retardation and interference, it is the chief obstacle to long-distance telephoning and ocean telegraphy. This trouble is very much increased in underground wires, because they are necessarily very much closer together, the induction increasing inversely as the *square* of the distance between the wires. The induction is also increased by the presence of a good intervening insulator necessary to keep out water and prevent electrical leakage.

As induction is in no way a leakage, it is not remedied by good insulation, but depends upon the power to transmit induction of the substance lying between the wires, whether it be air or a solid. This property is known as specific inductive capacity. Unfortunately, the substances which transmit induction the least, are the poorest insulators. For example, resin and pitch transmit only one-third as much induction as gutta percha; but gutta percha is a much more effective insulator than resin or pitch. And in a general way, it is the same with all substances—the best insulators giving the most trouble from induction. The single exception to this rule is air, which is the best insulator known except when damp, and at the same time causes very little induction. Air transmits less induction than pitch, or any other solid insulator. These facts doubly augment the trouble caused by having wires bunched close together in a conduit.

A Method of Measuring the Electromotive Force of the Voltaic Arc.

This method, devised by V. von Lang and described in



Measurement of E. M. F. of Voltaic Arc.

Centralblatt für Electrotechnik, is a very ingenious one, and is well worth notice.

Referring to the figure, E_1 and E_2 are a number of cells joined up in series and divided into equal halves; l_1 and l_2 are two similar arc lamps; *A* is an ammeter (of practically no resistance), and R_1, R_2 is an adjustable or slide resistance. A galvanometer is connected to the points *a* and *b*, and the resistances R_1 R_2, adjusted on the point p_2, slid along the latter until no deflection is observed on the galvanometer; that is, until the potential at the points p_1 and p_2 are the same. Under these conditions the points *a* and *b* can be connected to an ordinary Wheatstone bridge and a resistance measurement made, which resistance will be the combined resistance of the battery E_1, lamp l_1, resistance R_1, joined in multiple arc with the battery E_2, lamp l_2, resistance R_2: which combined resistance, as each half of the battery and each of the two lamps are made as nearly as possible similar, will be one-quarter of the total resistance in the total battery circuit. Having thus ascertained this latter total resistance, and having observed the current flowing by means of the ammeter *A*, the resistance multiplied by the current gives, of course, the total electromotive force in the circuit, and as the electromotive force of the battery E_1 E_2 is an approximately

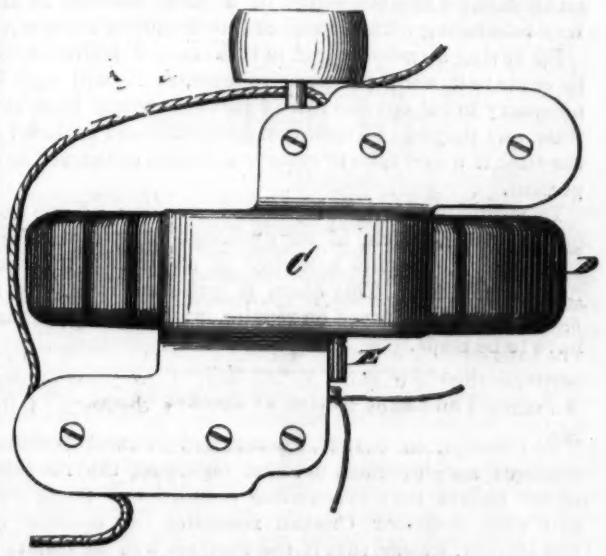


Fig. 2.—The Fisher Motor.

known quantity, the difference between the latter and the calculated electromotive force is obviously the sum of the electromotive forces of the lamps l_1 l_2, and as the latter are approximately equal, this sum divided by two is the electromotive force of each lamp. In an experiment made by V. von Lang, assisted by Prof. Exner and Dr. E Lecher, 58 Bunsen cells were used and two lamps with 5 mm. carbons, the latter being set .3 mm. apart. The calculated result gave a current of 4.33 ampères and an electromotive force in the lamps of 39 volts.

Protecting Compasses.—A special dispatch of Oct. 21 from Washington says: The Navy Department, in the construction of the new ships of war, expects to be able to introduce a device by which all danger from deviation of the ship's compass will be avoided. The device is said to consist of such an arrangement of counter magnetic currents (?) about the needle that the iron of the ship can have no effect upon it.

Wiring the Multiple Switch-Board.

BY G. S. MAXWELL, ELECTRICIAN OHIO VALLEY TELEPHONE COMPANY.

To those who are contemplating the adoption of the multiple switch-board, I wish to offer a few suggestions in regard to what I consider the best system of wiring them. In this article I do not wish to be understood as speaking against the board, for I consider it the best exchange system in use; but in all appliances, no matter how much theoretical study may be expended on them, there are apt to be defects more or less serious that can only be learned by experience. When these are found we naturally look for some means of correcting the evil.

After a year's careful study of the boards in our Louisville office, I find that about the only thing to be contended with is the trouble in reaching or removing any part that may have to be repaired. As a solution to this, I offer your readers a system of wiring that far exceeds the present, both as regards economy in construction, as well as facility in reaching any part that may have to be removed or repaired.

In the present manner of connecting up the tables, as the majority of the readers of this article will know, the wires or cables are led through holes in dividing boards that separate the jacks into divisions. The part of the cable extending through this board has the outside covering removed and the wires sewed together to correspond to the distance between individual jacks. Each row of twenty jacks requires four twenty-wire cables. Now two of these are led through each of the dividing boards on either side of the sections, and as the rows of jacks are fastened in place by screws that are only one-half inch from the dividing board and directly behind the cables, it becomes almost an impossibility to remove a section of jacks; and in case it becomes necessary to solder one of the connections in this maze of wires, the repair man is apt to use language more forcible than polite.

In case of fire from any cause breaking out in one of the sections between the dividing boards, the flames will be drawn upward and the chances are that the insulation will be burned off the wire, and the jacks in the immediate neighborhood destroyed; or the fire may be confined to one side in a space four or five jacks wide, but running upward a distance of ten or twelve rows. In the present manner of connecting, it is necessary to cut loose all the cables running to these sections of jacks before they can be removed, which can then only be done with difficulty.

But to come to the point and to give my plan: It consists in bringing the four cables running to any set of jacks directly behind the centre of them and spreading the wires to them like a fan. This will give access to any set of jacks and do away with the dividing boards as well. In case of fire from any cause, or injury to a jack, by simply loosening the screws which fasten in that row and drawing aside the four cables running to it (which, by the way, are sewed together), the row of jacks loosened may be easily withdrawn, or, if necessary to remove all the sections of jacks in a division for the purpose of examination, it can be done, and the rows of jacks laid back on themselves like the leaves of a book, without in any way interfering with the rest of the circuits in the system.

By having a system wired in this manner additions can be made to it with comparative ease, as it will only be necessary to cut out one row of jacks or twenty lines at a time, and they can be removed, connected and replaced in the time it would take to remove a section connected as at present.

In wiring in this manner, there is a saving of one foot on each cable, which, in an exchange of two thousand subscribers, represents a saving of about two thousand five hundred feet. This alone is quite an item, not to speak of the labor saved on repairs or additions that may have to be made.

The Legal Status of Bucket Shops.

At Chicago, on Oct. 24, Corporation Counsel Hoffman rendered an important decision regarding the licensing of the bucket shop speculating institutions. Some time ago City Collector Onahan requested an opinion on this subject, stating that if the business was legitimate it ought to be licensed, and if not bucket shops ought to be absolutely and entirely suppressed in the city. The opinion of the Corporation Counsel on the subject is that, while the State laws on gambling are not broad enough to cover the bucket shops, the managers are not, in fact, brokers. Clearly, he thinks, the collector should decline to throw about them the protection afforded by a license from the city. If the city has the power to license them, and does so, these licenses would protect them against prosecutions under the State law. By declining to license them they will be left amenable to whatever action may be taken under the criminal law of the State, either as it now reads or as it may be amended by the Illinois Legislature.

On receipt of this opinion Collector Onahan sent a copy to the Mayor, recommending that the matter be referred to the Police Department for prompt action. The Mayor was not fully prepared to act in accordance with the opinion, which conflicts with those of former corporation counsellors, and said he would confer further with Mr. Hoffman. The Mayor said as for himself he would rather have fifty gambling houses in Chicago than one of the dangerous bucket shops, and he intended to close them all, if possible.

An Improved Burglar Alarm.

The practice of protecting private dwellings by means of burglar alarms is rapidly extending. An improvement

Improved Burglar Alarm.

in such apparatus has recently been designed by Messrs. Hazazer & Stanley of this city, who pay special attention to such work. The apparatus is shown in the accompanying illustration. This burglar alarm is provided with the battery and silent test and continuity attachment.

The armature of each drop is pivoted and kept in place by gravity, thus requiring no springs. When once adjusted there is little liability of getting out of order. The wires are attached to connections on the backboard, from which the case containing the works is readily detached. The cases are finely finished, special care being taken to make them ornamental in appearance.

Another style of burglar alarm made by the same firm has a fine fifteen-day-pendulum movement arranged to disconnect any desired section at a set time in the morning.

A Powerful Telephone Transmitter.

In a paper read at the last annual meeting of the American Institute of Electrical Engineers, Mr. Thomas D.

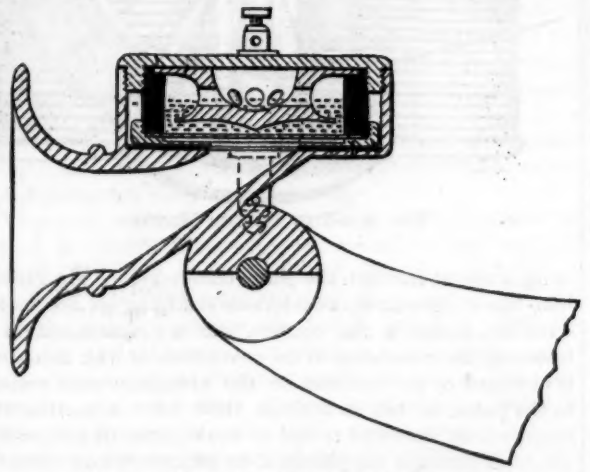
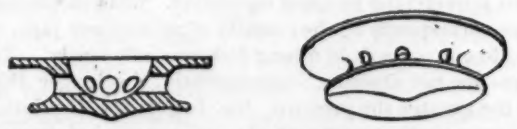


Fig. 1.—New Telephone Transmitter.

Lockwood remarked that successful long-distance telephoning depended largely upon the transmitters used, and that those of the Hunnings type were very good so long as the carbon particles did not begin to "pack." The main condition for successful operation, therefore, is that the conducting particles must be maintained in a loose condition and free to move with respect to one another upon a relatively small vibration of the movable electrode.

With this object in view, Mr. Geo. L. Roberts, of Bos-



Figs. 2 and 3.—New Telephone Transmitter.

ton, Mass., has designed a transmitter which, though resembling others in some respects, has a distinctive form through which excellent results are obtained. Our illustration, Fig. 1, shows a section of the transmitter, and Figs. 2 and 3 the upper electrode in section and perspective. As will be seen, both the upper and lower surfaces of the latter are flanged, and a groove is formed by the space between the flanges. A conical or hemispherical depression is formed in the upper surface, and, for convenience in introducing the granulations, is united with the groove by radial channels or canals. The form of that surface of the fixed electrode which is opposite to the diaphragm may be described as an inverted conoid with curved sides. Good results have been obtained, it is said, when the concave sides have been made in the form of a parabolic or hyperbolic curve. From the apex of the conoid the declivity of the curve is at first somewhat steep and abrupt, but becomes more gradual and reaches its greatest depression at a point about half the distance between the apex and the outer edge of the base, and after reaching that point the curve ascends again toward the edge or lower flange of the electrode, and finally terminates in a flattened surface at the extreme edge. This electrode is mounted in the ordinary metallic case, integral with the mouthpiece.

The vibrating diaphragm which constitutes the front or movable electrode rests upon a shoulder in a plate which lies on the floor of the outer case, but which is insulated therefrom by an interposed non-conducting plate through which the shank of the screw terminal passes, this being in metallic contact with the plate, which forms the lower electrode. A cap is provided, which closes the entire chamber, being fitted with a screw-thread. The side wall of the inclosing cell is non-conducting, and consists of a ring, which is placed in the outer case, and held in place between the diaphragm seat and the cap. A shoulder is cut in the internal periphery of this ring and serves as a seat for the upper flange of the pendent electrode, which for this purpose is made wider than the lower flange. The vibrating plate is connected with one side of the circuit through the metallic plate upon which it rests, and the lower binding-screw (shown in dotted lines), and the pendent electrode is united with the other side of the circuit by means of its contact with the cap and upper binding-screw. The granulated conducting material is introduced by pouring it into the hemispherical cavity and shaking the instrument, so that the mass passes down through the lateral holes and is deposited upon the diaphragm and surrounding the flange of the lower surface of the pendent electrode so that the lower flange is at all times covered by the conducting material, whereby it is made impossible to break the circuit.

When, in the operation of this transmitter, the sound-waves of the voice are directed upon the diaphragm through the mouthpiece, the conducting particles resting upon the diaphragm at or near its centre are agitated and receive from the plate an upward tendency. Reaching the conoidal apex or the concave curved sides, they are reflected therefrom at an angle, and again reach the diaphragm, but necessarily at a position thereon differing from their original one. Meanwhile their original places are filled by other particles. The same is true of the particles nearer to the wall of the chamber, although in a lesser degree, inasmuch as the amplitude of vibration of that part of the diaphragm is not so great as in the centre. The particles are directed against the curved surface near the edge, and are caused to rebound in a direction toward the centre of the diaphragm. The extreme edge of the lower flange is slightly flattened on its lower surface to prevent muffled transmission, which has been found to occur if the curve is continued to the extremity. Thus the particles, being at no time suffered to fall in their original positions, are virtually deprived of their normal tendency to pack.

Self-Induction in Voltmeter Coils.

In reply to a correspondent, M. Hospitalier gives the following experiment, to illustrate the effects of self-induction in the coils of a voltmeter: Place in circuit an incandescent lamp, an electro-dynamometer, a resistance without self-induction, and an alternating current machine, and connect the voltmeter in parallel with the lamp. By adjusting the speed of the machine and the value of the resistance, bring the lamp to its normal luminosity; note the readings of the dynamometer and the voltmeter. Now increase the speed of the machine, and by adjusting the resistance again reduce the lamp to normal incandescence. The dynamometer reading will be the same as before, but the voltmeter reading will be smaller. The greater the increase in the velocity, the greater will be the difference between the two readings of the voltmeter. Are we to imagine that the number of watts consumed in the lamp is different in the two cases? Certainly not. We are simply to conclude that a voltmeter containing a coil inductively wound, especially if there be also a soft iron core, is utterly useless for measuring alternating currents.

A Lesson for Lightning.—Lightning struck a hive of bees in Kansas the other day. The painful story is soon told. The misguided lightning came out of that hive quicker than it went in, and went off into space with its tail between its legs. Moral: Never pick a quarrel when you are not acquainted with the folks. *Texas Siftings*.

Patents on Electro-Plating Dynamos.—An important decision has just been rendered in the Chancery Division of the High Court of Justice, London, before Mr. Justice North, in the suit of Abram Van Winkle, of Newark N. J., U. S. A., vs. William Alexander Carlyle, of Birmingham, England. This was a suit for infringement of dynamo-electric machines for electro-plating owned by the said Van Winkle, of the firm of Hanson, Van Winkle & Co., Newark N. J., and has been some time pending in the English Courts. An interim decree for injunction having already been granted, it has now been made absolute; the defendent being restrained during the continuance of the letters patent or any extension thereof from making or selling any magneto-electric machines under or in accordance with or in violation of the letters patent on which the suit was brought.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Oct. 25, 1886.

The India Rubber and Gutta Percha Insulating Company, 159 Front street, this city, have produced some very excellent work in insulated wires and cables. They believe in the combination of wires for large conductors, making them pliable and of high conductivity. I have seen numerous specimens of their work in various styles of insulation, for underground, submarine and aërial use, also for abattoirs, tanneries and the like, and all the cables have been of different grades and qualities to suit the requirements, while showing high skill in the art of manufacturing them. The company's foreman, it is interesting to note, was with the great English house of Siemens for over twenty years, and has high testimonials from them. One of the latest ideas of the company has been the preparation of detailed measurements of all sizes of wires, with resistance, conductivity, etc., and with a sample of the wire placed immediately opposite the figures. The whole is inclosed in a handsome hardwood frame and glazed, so that it can hang in one's office as ornament and for reference. Every telegraph, telephone and electric light company should send for this new "chromo." It will be of use to them.

There is little to report that is new in connection with subway matters, except that Mr. J. Elliot Smith, the energetic superintendent of New York Fire Telegraphs, has been the first to use the conduits already laid, and has already put under ground 920 feet of Standard (Waring) cable, furnished by Mr. G. L. Wiley. A six-wire cable was used. The work of drawing-in proved a little difficult at first, but it is now likely to be easy as experience is gained. A way is said to be found out of the complications which have hindered the work in the past, and the talk is again revived that the telegraph and telephone companies are trying to get control of the construction company. At any rate, a new plan is being considered. Instead of pushing the work any further below Twenty-first street, it is now designed to hurry the Dorsett conduit as fast as possible to Fifty-ninth street. There a turn will be made to Eighth avenue, then up Eighth avenue to 125th street, through that street to Lexington avenue, and down Lexington avenue. The Dorsett Company will, the newspapers say, have no part of this work, but both the Averell and Neuchatel companies have a chance. This means about ten miles of conduits, but it is planned to have it all done before the 1st of January, the final tests not to be made until the conduits have been under ground for some months.

Some interesting evidence was heard to-day in the suit of Webster Gillett, inventor of the long-distance telephone, against Gillett & Miles, the Wall street brokers, for $30,000 for the alleged wrongful conversion of 6,000 shares of stock of the Long-Distance Telephone Company. A contract dated April 30, 1885, between Webster Gillett and Gillett & Miles was admitted in evidence. This document acknowledged the receipt by Gillett & Miles of 6,000 shares of Long-Distance Telephone stock as security for the faithful performance by the inventor of negotiations in behalf of the enterprise in Europe. The agreement specified that these 6,000 shares would be returned to Webster Gillett on or after October 1, 1885. Failing to get the stock, Mr. Gillett sued for its value, $30,000. The firm claim a lien on the stock for moneys advanced to the inventor to pay his expenses to and from Europe. Mr. H. H. Thomas testified that he had been employed to get Webster Gillett drunk and then to obtain the inventor's signature to a releasing document, but that the more Gillett was plied with liquor the clearer-headed he grew. I don't know much about the merits of the company, but there were undoubtedly some good points about the telephonic apparatus with which Gillett flattered himself he could talk across the Atlantic.

W. T. H.

BORDENTOWN, N. J., Oct. 21, 1886.

Mr. H. M. Sciple, of Philadelphia, the builder of the "Electric" engine and boiler made here, as illustrated and described lately in THE ELECTRICAL WORLD, has just issued a new catalogue, one of the finest and most elaborate of its kind. Speaking of recent work, Mr. Sciple says: "I lately put in the Evans Building, at York & Willen's, Philadelphia, a fine 35 h. p. engine and boiler, all steel, which gave most excellent results. I also removed a well-known 9½-inch cylinder engine from Broad and Arch streets because it would not furnish enough power and because it would not run the dynamo and a 4-inch pipe-cutting machine at the same time with the required regulation; and I planted in its place one of my 7-inch cylinders, which furnishes nice, even work, runs the dynamo and cuts 4-inch pipe at the same time. I also very lately placed an 8 inch × 8 inch in the Philadelphia *Inquirer* office to run the dynamo and two large printing presses at the same time. Also one in the printing house of W. R. Wheeler, 216 Market street; one in Gardner's Weaving Mill; one at Kellogg & Lambert's Shoe Factory. All these are in Philadelphia. I have also put in one at Riverside, N. J.; one at Gloucester, N. J.; one in the New Jersey *Temperance Advocate* office, Camden, N. J.; one at Flemington, N. J., in Case's vinegar house; one in John Bower & Co.'s meat house, Second and Morris streets, Philadelphia, all within three weeks. Many more orders are on the books."

This is a pretty good record. Mr. Sciple has an engine and boiler that will meet the special requirements of a great many lighting plants, and now he is devoting some attention to that field, there is no doubt he will have good success in it. Mr. Sciple is agent in New Jersey and Eastern Pennsylvania for the Ball engines, and recently had Mr. Howard, secretary of the Ball Company, of Erie, visiting him at his place, 101-7 North Third street, Philadelphia.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Oct. 25 1886.

The Gamewell Fire Alarm Company of this city and New York has just closed a contract for its system in Buffalo, N. Y.

The Malden, Mass., Aldermen, at their meeting on Tuesday night, Oct. 19, gave the agent of the Edison electric fire-extinguisher permission to hold an exhibition in Central Square, that city, on the following Saturday.

The manager of a telegraph company in New Haven, Conn., has gained considerable notoriety by evading the law relative to the erection of poles on public streets. On Sunday, Oct. 17, two enormous telegraph poles, one ninety and the other eighty-three feet in height, were erected without interference. Had this been done on any other day, an injunction would have been served.

Mr. Samuel H. Willard has resigned as president of the Holmes, Booth & Haydens Manufacturing Co., of Waterbury, and George C. Thomas as superintendent. It was only a few months ago that Mr. Willard was called from his place as manager of the New York house to take the presidency of the whole enormous concern, one of the largest brass companies in the world. The amount of metal used in this factory in one day averages about 30,000 pounds.

The Woonsocket (R. I.) *Evening Reporter* of Oct. 19 contained the following:

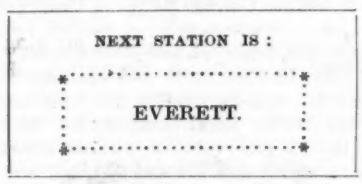
The first electric motor ever used in Woonsocket has been put into the job printing rooms of J. U. Giguere, Central Block. It is of the Sprague patent, and the power is furnished by the Woonsocket Electric Light and Power Company. The capacity is half a horse-power, and it easily runs two Gordon presses. It is understood a number of these motors will be used in the near future.

On the evening of Oct. 23 the New England Club, of Boston, entertained the editors of the Hub's leading papers at a dinner given at Young's Hotel. Many spicy and original stories and anecdotes moved the distinguished gathering to laughter and applause; and Col. Roland Worthington, of the *Traveller*, told how another editor and himself, a long time ago, played a game of chess by telegraph, the contestants being at Baltimore and Washington respectively.

The main offices of the Baltimore & Ohio Telegraph Company, No. 33 Milk street, Boston, have been enlarged, rearranged and refitted, and all the departments are now on one floor, with entrances leading from Milk and Arch streets. The operating room is now one of the largest and most completely equipped in the New England States; and additional operators are being put to work continually to enable the company to keep up with its steadily increasing business.

In addition to the main office, the company has twenty branch offices throughout the city; in fact, an office in each business centre. There is an evidence of good management and perfect discipline about the main office and branches, and this can be traced to the conscientious and painstaking labors of Mr. Chas. J. Sheehan, the superintendent of this district.

On Thursday, Oct. 21, I made a trip over the Eastern Division of the Boston & Maine Railroad—between Boston and Lynn—and to my gratification noticed that the cars were equipped with the Bickford electric station indicator. As the train swung out of the Boston depot, there sounded forth a distinct "twir-r-r," accompanied by a resonant twang of a gong, and all eyes were attracted to the handsome rosewood box in the front upper left-hand corner of the car, on which, in large letters, was the following:



Then, again, as the cars moved out of the Everett depot, the "twir-r-r" and twang were repeated, and the passengers notified that Chelsea would be the next station stopped at. The apparatus worked correctly and the passengers were delighted; every station between Boston and Lynn being properly announced in advance. Conductor Johnson, being questioned as to his opinion of the station indicator, said, quite eloquently: "It will prove an invaluable adjunct to every first-class railway system; and when once the apparatus is applied to cars, the patrons of the road running those cars will insist upon the indicator being permanently adopted." It notifies the passengers in plain words of the name of the next station at which the train is to stop, contributing much to their comfort by enabling them to collect their baggage and be ready to alight when the train stops, and every day will prevent many people being carried beyond their destination. The Bickford station indicator is operated by electricity, and every machine in the train is moved simultaneously, and its parts are entirely interchangeable, making it applicable to roads having numerous branches. It is very simple, and therefore is not liable to get out of order, and is easily understood by trainmen. It can be placed under the supervision of one man, which insures the perfect operation of all the machines in the train. The apparatus is manufactured by the Bickford Railway Station Indicator Company, Salem, Mass. The officers of the company are: John P. Peabody, president; John H. Bickford, treasurer and general manager; W. S. Nevins, secretary.

The Edison United Manufacturing Company has just added 200 incandescent lamps to the 720-light plant previously installed in the mills of the York Manufacturing Company at Biddeford, Me.

It is said that "Mayor Stone, of Waltham, Mass., will sign the order appropriating money for 25 arc lights for lighting the streets of that city." It is further stated that "the appropriation thus obtained, together with the revenue derived from commercial sources for both arc and incandescent lights, will be sufficient to cover all the present expenses of running the entire plant."

A new electric light syndicate has been organized at Beverly, Mass., and has purchased the plant which was established there some months ago, but which has not been running since the refusal of the town authorities to adopt electric lighting. The new syndicate has received assurances from the recently elected authorities that the main streets of the town will have to be lighted with electric lights. It expects to furnish lights about Nov. 1. When Salem lights her end of Beverly bridge by electric light Beverly ought to do the same, and without doubt will do so.

The Suburban Electric Light and Power Company, of Brookline, Mass., has been formed for the purpose of supplying light and power in Allston and Brighton. The officers are: President, Dr. Robert Amory; Treasurer, Francis W. Laurence; General Manager, C. W. Holtzer. The headquarters and station will be at the gas company's works.

The management of the Woburn, Mass., Gas Light Company contemplates taking stock in and enlarging the electric light plant (Edison system) established last winter by N. J. Simonds.

It is proposed to increase the plant for the purpose of lighting dwellings. By this arrangement all dwellings within a mile or so of the centre can be supplied with the light. The present system is a great success.

I take the following important item from a local paper:

The recent action of the Boston Fire Commissioners in adopting the Gamewell non-interference box adds another to the many improvements made in the fire-alarm apparatus of the city under the superintendence of Captain Brown S. Flanders. Captain Flanders was placed in charge of this branch of the service only six years ago, yet within that time he has put up about 500 miles of new wire, and in doing so has entirely changed the method of support, so that at present every wire runs on firmly and neatly-built structures or poles well above all other lines in the vicinity. This latter feature is carried out in accordance with a well-approved system, so that the old danger from telegraph, telephone and other wires falling upon the fire-alarm circuits has been done away with. In fact, the entire work of rebuilding the lines has been done with a thoroughness and system unexcelled. Moreover, the lines, a perfect net-work of them, enter the dome of City Hall in a most systematic way, so that what would seem at first thought to be a hopeless labyrinth is as clear and distinct to the officials as the stops of an organ to the musician. The battery and other rooms containing hundreds of cups of battery, long rows of lightning-arresters and other appurtenances, are as orderly and well kept as though the apparatus were the simplest imaginable. The operating room, likewise, has undergone entire change under the guidance of Captain Flanders, so that with the various specimens of beautiful workmanship in the form of registers, transmitters, indicators, galvanometers, etc., it is not at all surprising that not a day passes by without the attendance of many admiring and interested visitors. Nevertheless, constant additions and improvements are taking place, the Fire Commissioners and the superintendent being ever on the look out for anything which will enhance and improve the service. The change from the ordinary to the non-interference boxes was not decided upon until the Commissioners and the Superintendent had thoroughly examined the improvement and its workings in other cities. Then, feeling that it was undoubtedly a vast stride in advance, they made no hesitation in placing it in their boxes. By the use of these improved boxes the chance of receiving confused alarms when two or more boxes are pulled at about the same time is removed, whereas, with the ordinary boxes, frightfully expensive delays may occur at any time despite the utmost precautions of the Superintendent and his assistants. The loss of a few minutes in time of fire may involve the destruction of untold amounts of property and often of life, so that whatever increases the certainty of correct and prompt notification to the fire men is of the utmost value and importance, for, however excellent the fire department, it cannot act until it has received notice of the presence of the enemy. The non-interference boxes will be placed on what is perhaps the most important circuit in the city first, and will be added to the others as ordered by the Board of Fire Commissioners, the contract with the Gamewell company requiring the latter to change all the boxes in the city, about 360 in number, in such quantities and at such time as it may please the board to direct. The work of changing over will devolve considerable extra duty upon Captain Flanders, but the pride which he feels in his alarm and his desire to make it as efficient as possible are considered by him to be amply sufficient compensation.

The remarkable—and what may be properly termed phenomenal—progress of the Thomson-Houston Electric Company's system of electric lighting is attracting attention throughout the country and abroad. In a conversation with one of the officers of the company last Saturday, I was informed that "on that date (Oct. 23) the Thomson-Houston Electric Company was two thousand arc lights behind its orders; but with its present enlarged manufacturing facilities it was thought that by December a sufficient number of dynamo machines and lamps would be finished to enable the filling of all back orders and the prompt handling of all new orders."

W. I. B.

PHILADELPHIA NOTES.

PHILADELPHIA, Oct. 25, 1886.

The electric light men in this vicinity, and many other electricians, took great interest in the annual convention, on Wednesday and Thursday last, of the American Gas-light Association. The papers read, and the discussion on the general subject of illumination, were decidedly interesting. There was nothing said about the electric light having hurt their business in any way, but when we remember the grasping policy of the gas companies a few years ago, it sounds like a change to hear the president of the association say in his annual address that "a large amount of the prejudice existing to-day against the gas companies of the country has grown out of the short-sighted and illiberal policy of the managers of the gas-light companies of former days," and "that all the gas companies of the country were interested in conducting their business in the interests of consumers as well as their own, and if the welfare of the former was disregarded by any corporation it would fall into disrepute." Still, there was no admission that electricity was cutting into them in any way, though a statement from a paper read by George G. Ramsdell, of Vincennes, Ind., would indicate that there is a leak somewhere.

The history of gas making had for years, he said, tended to show the necessity of greater security and more stability in value of stocks and greater protection in corporate rights and franchises of gas-making companies. This had been abundantly shown in the efforts to create some centralization of forces to be used against the consummation of nefarious schemes manufactured solely for self-aggrandizement or malicious prosecution. These efforts have failed, and the only remedy now was the establishment of a gas commission. The millions at present invested in gas property were in a helpless condition, and there was no other line of business with similar investments that had not banded together for self-protection.

Of the price of gas it was stated that the lowest price charged by a coal gas company was 90 cents per thousand feet, and the highest $6 per thousand feet. The average price for the United States for coal gas was $1.73 99-100 per thousand feet.

Thomas Turner, of Charleston, S. C., was called upon to give some account of the effect of the earthquake in his city upon the

service of the gas works. He stated that the mains had been damaged and connections at intersections of streets severed. About 150 breaks occurred in all. The discussion of the subject of natural gas as a cheap illuminant was also very interesting. I have said the electric light people were present in force as spectators, and I must add that they were furnished with food for reflection, or argument, in a paper on "A Comparison between Gas, Electric Lighting and Oil," read by E. A. Stevens, representing the Siemens Gas Lamp Company, of this city, and another on "Electric Lighting," by C. F. Spaulding, of Brookline, Mass.

All the electrical people of Philadelphia were treated to a genuine surprise last week. Although the City Councils have for years been passing stupid and impracticable laws to compel the various companies to bury their wires, yet at their meeting on Thursday last, Select Council refused by a vote of 14 yeas to 9 nays to allow the Bell Telephone Company to lay underground conduits. And this too in the face of the fact that on the very same day three ordinances granting permission to telephone and telegraph companies to lay undreground conduits were passed almost unanimously by the same body of politicians.

The companies which received permission to bury their wires are the Postal Telegraph and Telephone Company, the Penn Electric Company and the American Telephone and Telegraph Company. The ordinances granting the above companies privileges were concurred in Common Council.

I don't understand the true inwardness of all this, but I think the following reply is about correct. It is the answer of one of the better class of Select Council.

When asked why his colleagues refused to allow the Bell Company to place their wires underground, he replied: "They did it to be consistent."

"Consistent with what?"

"With their past efforts to make all the electric companies take up their wires and string them overhead," he replied sarcastically.

Underground cables for incandescent electric lighting are being laid for the use of the Keystone Light & Power Company on Bennett street, from Seventh to eighth; Seventh street, from Sansom to Jayne; Jayne street, from Seventh to Eighth, and Sansom street, from Sixth to Seventh. The station has been in operation for about three weeks, and the work of extending is being pushed as fast as possible. The light has been introduced into several buildings in the vicinity of Seventh and Chestnut streets.

At last Wednesday's stated meeting of the Franklin Institute, Mr. W. M. Schlesinger read a paper upon the Schlesinger system of electric transmission, giving an account of its trials upon the upper line of the Ridge Avenue Passenger Railway, describing the vital features of the system, and showing that it had proved a success.

Uniontown, Pa., Oct. 19, 1886.

The Pennsylvania Construction Company has procured of the Brush Electric Company, of Cleveland, a No. 5 arc light dynamo, type H. with a capacity of 15 lights of 2,000 c. p. The lamps are duplex, for all-night service. Six of these lamps are used in the company's building, while the other nine lamps will be put on the rolling mill and steel works property adjoining. The machine has all Mr. Brush's latest improvements. It does its work with little noise and less sparking. It is the intention of Mr. Harry Butz, the superintendent, to employ his men night and day until all the huge buildings now in course of erection are completed.

Messrs. McCoy & Frost, dealers in electrical supplies, at 413 Broadway, have now been in business here over two years. During that time they have fitted up a large number of new buildings complete with electric gas lighting apparatus, annunciators, burglar alarms, thermostats, etc. They have also equipped several new establishments for the incandescent system.

The Uniontown Electric Light Company, chartered here some time ago, has done nothing practically towards putting in a central lighting station, as was their original intention, and this in spite of the fact that a good many of the stockholders had their houses wired completely for both arcs and incandescents. It is a pity something is not done to put matters in good shape.

There is considerable talk, and great probability, of having the new County Home furnished with 300 incandescent lamps of 16 c. p. from an isolated plant.

WESTERN NOTES.

Branch Office of The Electrical World,
Chicago, Oct. 23, 1886.

One of our local dailies has been looking around town to see how much progress is being made in the work of putting the electric wires underground. The following is the result of the investigation:

"Prof. John H. Barrett, the city electrician, who built the first underground conduit for telegraph wires in this city, said to a reporter:

"We are going on with our work reasonably fast. The trouble is that there is such a demand for cables that the manufacturers cannot supply enough of them. The city has about sixty-five miles of wire laid through 7,931 feet of conduits, built and owned by the city. All the city wires are underground from Van Buren street to the river and from the river to Michigan avenue. The trunk line divisions will be up to Erie street on the north, to Harrison on the south and to Clinton on the west this fall. The poles are being removed from that district. Our great object is to get the heavy trunk aërial lines from our large buildings. We have also twenty miles of single wire laid through four miles of conduit owned by the Underground Sectional Conduit Company and ten miles of single wire under the sidewalks in the central part of the city, covering an area of nearly a square mile. With them are connected all the municipal telegraph and telephone apparatus in that part of the city."

"There is this fact about underground cables," said Mr. Charles H. Summers, the electrician of the Western Union Telegraph Company, "that the people and the city authorities do not appreciate. Our aërial system in Chicago is the result of years of growth. It has grown—especially on the south side—in every direction; and to put all these wires down underground as a regular system must be necessarily slow work. We have overhead lines on every street, and, as the conduit would go through one or two streets, it is rather difficult for us to get them down at the place where we want them to enter the conduit. We have already taken away the poles on most of the streets from LaSalle street to Michigan avenue, and from the river to Jackson street, and there is a large number now on the south side that we contemplate removing as soon as we can get some more cables, which are being manufactured in New York. We expect to pull down a good many more before winter. We are going in the future south to the city limits. This matter of underground cables is, to a large extent, an experiment. We do not yet know how it is going to stand."

"All the underground cable work we are doing is in the line of experiment," said General Superintendent John E. Zeublin, of the Baltimore & Ohio Telegraph Company. "We cannot say how long these cables are going to last, but we can say that so far as we have gone, it has not been very encouraging. The practical result of the work we have done in this direction is shown by the increased number of complaints that they cannot make themselves heard. And for that reason we take the new cable that we are using in preference to many others, because it is radically different from anything we had previously experimented with. From the New York experience with this new cable, it is holding out a promise of being more of a success. The last cable of wires we put in runs from Jackson and distributes 100 wires at Jackson and Dearborn streets, Jackson and Wabash, Harrison and Wabash and at Twelfth street. Every pole north of Harrison street to the river has been removed—we have made a clean sweep. We have nearly five miles of conduit, containing 281,296 feet of wire, underground. We have had a good deal of trouble, but after we get thoroughly to understand this system it will be more satisfactorily operated. We are inclined to believe that the difficulties are purely mechanical in the construction of the cable."

"It will take us until spring to complete our underground system," said Superintendent B. E. Sunny, of the Chicago Telephone Company. "We already have a cable system on the north side, running from our office, on Chicago avenue and Clark street, to the north end of the La Salle tunnel, with 150 wires, and other cables on Wells and State streets, each with 150 wires, from the same office. Our system extends to the west side, and we are now putting down our south side system, from Calhoun place to Twenty-second street; then we have between Calhoun place and the Board of Trade, an underground cable of 250 wires. The cable is two and a half inches in diameter, and put into an iron pipe three inches in diameter, cleaned smooth, and filled with oil as an insulator. This cable is similar to one that has been used successfully in New York for a year, and they recommend it as being 'quiet,' and without the 'cross talk' or the peculiar sound that you hear in a telephone. We want to find out its result before we use much more."

"The Postal Telegraph Company has always placed its wires underground, and the Chicago Sectional Underground Company, which owns about seventeen miles of conduit, rents space to most of the electric light, telegraph and other companies."

Michigan City, Indiana, owns and operates an electric light plant. The city, as a corporation, has been sued by the Fort Wayne Jenney Electric Light Company for the infringement of two of the latter's patents. The patents under which suit is brought are numbered 262,554 and 334,023, and are dated respectively August 8, 1882, and January 12, 1886, both being granted to J. A. Jenney. One is a dynamo and the other a lamp patent.

Munson & Company, of this city, have just received an order from the Alleghany County Light Company, of Pittsburgh, Pa., for two dynamo belts, each 122 feet long and 36 inches wide.

A local electric light company has been organized at Columbus, Ind., composed of business men of that city. The capital is $10,000, and the system to be used will soon be decided on.

The Jenney Electric Company, of Indianapolis, Ind., have secured the contract for furnishing a complete city plant at Bay City, Mich., including towers and mast arms.

The Edwards Electric Light Company, of Richmond, Ind., has been incorporated. The object of the company is the manufacture of electric locomotive headlights. The stock is $2,000,000, divided in shares of $50 each, and all subscribed. The officers of the company are James W. Carpenter, of Dayton, President; J. H. Kibbey, Vice-President; J. W. Carpenter, Jr., Secretary and Treasurer; Edgar A. Edwards, of Cincinnati, Electrician and Superintendent. The President, Mr. Carpenter, is a well-known monument contractor of Dayton.

It will no doubt interest many of your readers to learn that the contract for supplying the two 48-inch belts which will run the new machinery of the Chicago City Railway Company's cable system has been awarded the Underwood Manufacturing Company, of Tolland, Conn., manufacturers of the Underwood patent cotton leather belt. The general Western agents for this belt are Goulds & Austin.

Several friends met at the residence of James Lowth, 742 West Congress street, to witness some of the very curious and interesting features of his new system of transmission, by contact with the body of the speaker, through a solid medium instead of through atmospheric impulse, as practiced in all diaphragm instruments. In the new system the instrument is actuated by placing a button projecting from it against the side of the throat, the operator speaks, and the vibrations that occur in the exterior surface of the throat during the utterance of the words are conducted by the button and its stem to the electrodes, and they being disturbed, in accordance with the vibrations that form the muscular word, so to speak, transmit a perfectly articulate word. Conversation is carried on with facility through combined instruments, the tone is much louder and fuller than found in any of the diaphragm class, and its timbre is of a smoother and more solid character.

One of its peculiar and very important qualities is that it is independent of all accidental sounds or disturbances which so often interfere with the good service of the instruments of the telephone system; the speaker may be surrounded by any number of people talking loudly, and only his voice will be transmitted.

The loudness and clearness with which speech is transmitted with these instruments is wonderful. During the exhibition of this curious new principle, the inventor applied the button to the top of his head and transmitted speech in a perfectly clear voice, only not as loud as in the usual way of holding; also to the back of the neck, various parts of the chest and other parts of the body, all in a good, clear tone, every word well defined and intelligible. A test was made with a ten-pound weight of lead, and through this, as in all other cases, the transmission was perfect.

The inventor has a line at his house in operation having a two-mile resistance. He has taken out American and foreign patents covering this new art.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes me the following telephone stock quotations:

Bell of Mo.	$150@$151
Central Union	44@ 45
Chicago	375@ 400
Colorado	20@ 22
Cumberland	70@ 75
Great Southern	25@ 27
Iowa Union	16@ 19
Michigan	67@ 69
Rocky Mountain Bell	40@ 45
United	16@ 18
Wisconsin	104@ 106

W. A. K.

THE TELEGRAPH.

No Sale.—The sale of the property of the Bankers and Merchants' Telegraph Company has been adjourned *sine die* on the appeal of the United Lines Telegraph Company from Judge Lawrence's decision.

At the Fastnet.—It has been decided to abandon the telegraph station for vessels at Fastnet in consequence of the difficulty in keeping the cable there in good order. In future, vessels will be telegraphed from Brow Head.

A Necessary Accomplishment.—The German War Office has decided that all sub-officers must learn telegraphy. One hundred officers selected from the Berlin garrison and 100 from the garrisons at Strasburg and Metz have accordingly begun a course of tuition.

Election Returns.—The Western Union Company has obtained permission to run special wires to club-houses, etc., for use on election night, but the wires are to be removed next day. Owing to the unusual interest in the election this year, there is a larger demand for such service.

Tickers.—The managers of the New York Gold and Stock Telegraph Company have decided to appeal from Judge Cullen's decision adverse to them in their litigation with the Consolidated Exchange in regard to the use of tickers. The decision is to the effect that there can be no further interference with the tickers of the Consolidated Exchange.

Mackay-Bennett Land Lines.—The Mackay-Bennett Pacific coast telegraph line, extending from New Westminster, B. C., to San Francisco, 1,200 miles, is being pushed vigorously. Parties are working on the entire length of the line, which is to be completed to a connection with the Canadian Pacific not later than Christmas, affording a competing line from San Francisco and Portland to New York. The only obstruction thus far encountered has been by the Northern Pacific Railway between Portland, Ore., and Tacoma, W. T. The railroad company has ordered pole holes filled and refused to deliver construction material.

Old Officers.—The old officers of the Western Union Telegraph Company were re-elected last week at the first meeting of the Executive Committee of the Board of Directors held since the recent annual meeting of stockholders. President, Norvin Green; Vice-President and General Manager, Thomas T. Eckert; Vice-Presidents, John Van Horne, George J. Gould, Robert C. Clowry; Acting Vice-President and Auditor, J. B. Van Every; Secretary, A. R Brewer; Treasurer, R. H. Rochester; Attorney, George H. Fearon; Executive Committee, Norvin Green, Thomas T. Eckert, Jay Gould, John J. Terry, Russell Sage, John Van Horne, Alonzo B. Cornell, Samuel Sloane, Sidney Dillon, George J. Gould, Robert C. Clowry.

THE TELEPHONE.

The Wallace Suit.—It is said that a decision in the Wallace case is expected by the American Bell Company soon, and is likely to take the shape of a perpetual injunction.

The Van Rysselberghe System is now in use between Vienna and Bremen, a hundred miles, and will shortly be put in operation between Vienna and Pesth, a distance of over two hundred miles.

A Canadian "Anticipation."—Referring to the article in our columns, last issue, on the Barrett telephonic duplex system, Banks Bros., of Toronto, telegraph us as as follows: "A provisional patent in England was issued to Dr. Rosebrugh, of Toronto, fourteen months ago for the duplex telephone system described in last World."

Newark, N. J.—At the annual meeting last week of the Domestic Telegraph and Telephone Company, at their office, No. 792 Broad street, the following gentlemen were elected directors for the ensuing year: George W. Hubbell, Thomas T. Kinney, Thomas W. Dawson, Jabez Fearey, Edward Weston, Marcus L. Ward, Enos Runyon, J. H. Dawson, Jr., and Fred'k T. Fearey.

Providence.—The Boston *Traveler* says that the American Bell and Providence telephone people are to negotiate a merger. The proposition that has been under consideration is to increase the capital of the Providence Company from $250,000 to $400,000, of which 35 per cent. will be issued to the Bell people in three annual blocks, and $10,000 retained in the treasury.

After the Brokers.—It is said that an agent of the long distance company has been in Wall street endeavoring to contract with brokers having branch houses in New York and Philadelphia for giving telephone service. It is plain that a great saving of telegraph operators' salaries and special wire rents is to be effected by the use of the long-distance telephone, and it is likely that the line will be liberally patronized.

Philadelphia.—At Philadelphia, on the 8th inst., the Electrical Committee of Councils met, and agreed to report favorably an ordinance granting permission to the American Telephone and Telegraph Company to lay underground wires on a route beginning at Pier 7, South Delaware Avenue, from there on Walnut to Twenty-third, to Chestnut, to Thirty-second, to

Market and Lancaster avenues, and also on Fourth street, between Lancaster and Girard avenues. The ordinance has not passed Councils, however.

The Providence "Deal."—Latest New England advices are that the Bell people and Providence telephone people made a trade at their conference on Oct. 23. The Providence company is to increase its capital to $800,000, if it can get permission, and the Bell company acquires 35 per cent. of the Providence stock, also of the Newport and Kingston exchanges when acquired by the Providence company. It is said that of the 35 per cent. 5 per cent. will be held in trust, so as to comply with the Massachusetts law restricting Bell ownership to 30 per cent. of subsidiary stocks. The Providence company has a "melon" in assets to cut, equaling about $6 per share.

Nashville, Tenn.—Gen. Barney in his latest bulletin of the National Telephone Exchange Association says: The Nashville *Union*, of 12th inst., contains an extended account of the Telephone exchange in that city, in which the claim is made that if the Cumberland Telephone and Telegraph Company had rendered a statistical report to the meeting of this association at St. Louis, it would have shown that Nashville has one telephone station to every thirty-five inhabitants, which showing would have beaten Detroit and taken from it the first place accorded to it in the Secretary's report, for thoroughness of territorial development. The moral of this is, that the Cumberland Telephone and Telegraph Company should have sent in a report, which would have secured to them the honor due. Nashville has 1,226 subscribers to a population of 43,350 (census of 1880). Memphis, in the same company's territory, has 1,033 subscribers to a population of 35,592, an equally good showing. The rates in Nashville are low—$60 yearly per station for business purposes and $48 for residences—and the service is good. The central office is equipped with the multiple switch-board.

THE ELECTRIC LIGHT.

Doylestown, Pa., is to have some Thomson-Houston lights.

Bay City, Mich.—The cost of the plant proposed for this city is $30,000.

Middleville, N. Y.—The knitting mill of Nelson & Lansing will be lighted exclusively by an Edison plant.

Boise City, Idaho.—The capital stock of the new Boise City Electric Light Company, Mr. W. P. Chandler, president, is $25,000.

Hamilton, O.—The Hamilton Electric Light and Power Company has been organized by J. E. Neal, H. L. Macy and others with a capital stock of $50,000.

Dayton, O.—The Dayton Edison Light and Conduit Company has been incorporated with a capital stock of $100,000. The incorporators are H. H. Hoffman, A. Stuart and others.

Woodbury, N. J.—The plant of the Citizens' Electric Light Company will be ready before the end of the year. Mr. W. A. Flanigan is the President and Mr. W. Morse the Secretary.

Norwalk, O., is to have its wishes gratified. A special dispatch of Oct. 20 says: Last night by a unanimous vote the city council decided to close a contract with the Western Electric Company for the lighting of the streets and city offices of Norwalk with electricity. The proposed lighting by electricity gives universal satisfaction here.

Artesian Wells.—Mr. J. D. Case, of Plainfield, N. J., writes us: "Noticing in a recent issue your article on water-power in running dynamos, I may state that several years ago in Prairie du Chien, Wis., they sank a number of artesian wells, the water rising to a height of 4 feet or more. One party running a mill sank four close together and obtained power not only to operate the mill but to light it up and his house as well He wanted to furnish light to the town, but it being a sort of dead-and-alive place, he could do nothing. There was a perpetual power within reach of nearly every portion of the land." Prairie du Chien is still without the electric light, we believe.

The Hell Gate Light.—It has at last been decided by the Light-house Board to discontinue the electric light at Hell Gate. The opinions about the light vary. Among the companies against it were those sending the big boats to Newport, Fall River, New London, New Haven, Stonington, and other Sound ports. The reasons assigned were that while the pilots could see well inside the circle of the electric light, they could not see beyond it; that beyond it was a wall of blackness; that they emerged from that circle of light with eyes dazzled, blinded, and almost useless; and that hence the light was a hindrance rather than a help. Some eight or ten companies whose boats ply in the circle of the electric light almost entirely, replied in favor of its retention. The board has not fixed the date of the discontinuance, but it is to be shut off soon. The board is still open, however, to reason; and if it should be shown that the electric light ought to be continued, the board could be convinced.

The Rice Dynamo is on exhibition at the Denver (Col.) Manufacturers' Exposition. It is the first completed machine of a very bright young Denver inventor, Mr. Lewis C. Rice, formerly a pupil of the Denver University. The following lucid description is given of it: "The dynamo is twenty inches high to the pilot lamp. There are four pole pieces separated from each other, except by the electrical magnet, which unites them to the framework of the machine. The section of the armature is diamond shaped and bound with the usual methods. It provides 14 to 20 candle-power lights, while most machines only run ten. The machine only weighs 250 pounds and is provided with thirty pounds of copper wire. The armature has 2,000 revolutions a minute. The machine is known as 'The Lightning Dynamo.' All parts of the machine were made by Mr. Rice with his own hands. Mr. Rice was some six weeks in making the machine, working night and day in completing it, and working upon it some of the time for thirty six hours without sleep or any considerable rest." The Vitrite & Luminoid lamp is being used with this machine.

Ottawa, Ill.—The plant of the Thomas Electric Light and Power Company is now in admirable working order, and the management appears to be justified in the pride taken in it. The company was chartered in January, 1884, with an authorized capital of $10,000, which has since been increased to $15,000. The officers are: William Thomas, president; Douglass Hapeman, secretary and treasurer; and C. L. Ballard, electrican. They have two dynamos of an aggregate capacity of fifty-five lights now running, the power being supplied by a 150-horse power turbine wheel under a 26-foot head, the flume leading from the basin being an iron 4½-foot cylinder, the whole set on solid masonry. Should occasion require, as it undoubtedly will, another 75 or 100 horse-power wheel will be added. The building is two stories, the lower one being devoted exclusively to the dynamos—the two Thomson-Houston, and a Brush 16-light, for which steam power and floor space is rented. The upper story of the building is reserved to rent to such parties as may want power, and with the facilities afforded it will be strange, indeed, if it is not all taken very soon.

APPLICATIONS OF POWER.

Littlehampton, Eng., proposes to have an electric railway from the railway station to the Esplanade along the sea. Should the plan be carried out, Mr. Volk, whose electric railway at Brighton has been so successful, will undertake the construction and management of the new line.

An Electric Tram Car.—An electric tram car, destined for New York, says the London *Electrical Review*, has been worked for several days in the streets of Brussels, and has given complete satisfaction to the directors of the State railways, and to the various engineers in whose presence the trial trips have been made. The car, which affords accomodation for 70 passengers, has been constructed by the Julien Electric Company. The system adopted by M. Julien, the manager of the company, which has already been illustrated, received the diploma of honor at the exhibition held in Antwerp last year. The car is worked by accumulators.

Detroit, Mich.—The reports from Detroit of the working of the Fisher electric railway, from Woodward avenue to Highland Park, are most favorable, the cars carrying 40 passengers apiece at the rate of 15 miles an hour. The *Free Press* says: "Saturday the Highland Park Road was inspected J. L. Rook, of the Sandusky Street Railway Company, and by T. H. Williams, President of the Boston City Railway Company. Both gentlemen were enthusiastic over the new system. Boston doubtless has the most complete system of horse-car roads in the United Statis, and it is noteworthy that the company in that city is looking for something better."

The Hunter Electric Railway Company, of Philadelphia, write us: "We have been preparing data relating to all the electric railways throughout the world—both permanent ways and those which were erected for temporary purposes, as at exhibitions. The digest covers systems using a stationary source of energy as well as secondary batteries carried on the vehicles. We have also collected and digested much data relating to the cost and economy of electric railways. This data we propose to issue in the form of a pamphlet, as an addition to the matter descriptive of our various systems. In general terms, we may say that there have been run in different parts of the world between eighty and ninety electric railways.

PERSONALS.

Prof. S. P. Thompson is preparing a book on "Secondary Batteries." The work will be timely, and anything from one so able cannot but be important and useful.

Mr. Enos M. Barton.—At a meeting of the Western Electric Company's directors, held at Boston, on Oct. 19, Mr. Enos M. Barton, formerly vice-president, was elected president of the company, to succeed Mr. Smoot, deceased. The choice is a most happy one, and will conduce to the company's prosperity in every way.

Mr. E. H. Goff, President of the American Electric Manufacturing Company, which made a gift of the electric lighting apparatus for the Bartholdi Statute of Liberty, chartered a steamer specially for the marine parade and excursion on Thursday, the 28th inst., and invited a large number of friends of the company to witness the proceedings from her.

Mr. Charles F. Brush, of the Brush Electric Light Company, owns at Cleveland one of the largest and costliest stone residences in this country. He is determined, it is said, that the walk leading through his grounds from the street to his front door shall describe a true geometrical curve, and he has spent some hours of his busy days in instructing his workmen how to lay it, often getting down on his hands and knees in order to draw the line. The story, whether true or not, is characteristic of the man.

Mr. P. V. Luke, superintendent of Indian Telegraphs, Calcutta, who has been traveling about this country and Canada inspecting the latest telegraphic and other electrical novelties, left for England on Saturday last, per "Umbria." Mr. Luke is a good type of the best class of English officials, and made a great many friends while here. He left nothing new unvisited, made copious notes, and departed with many expressions of pleasure at the rapid development of electricity in America.

MISCELLANEOUS NOTES.

A Thousand Tons of Copper.—Roebling's Sons have this year, it is said, used more than 1,000 tons of copper in the manufacture of telephone and telegraph wire.

Wrecked by Her Cargo.—Advices from Nassau say that the crew of the British steamship "Juliet," which was wrecked on Gingerbread Ground, arrived at Nassau on the 14th inst. The cargo of coal and steel rails will be saved, and taken to Nassau. The disaster was due to the disarrangement of the compasses, caused by the steel cargo.

SPARKS AND FLASHES.

He Lost His Composure.—They ought not to have set the new compositor at work on technical matter, but they did. The copy read "polarized armature," and he got it "paralyzed amateur," and now he says type-setting has lost its attraction. He thinks he is better fitted for the stage.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

October 26, 1886.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	40	42
Am. Tel. & Cable	75	76
Cen. & So. Am.	75	100
*Com. Tel.	.....	.....
*Gold & Stock	90	95
*Inter. Ocean Tel.	90	95
N. Y. Mutual	66	70
Pac. & Atl.	45	55
*Postal T. & C.	15	.....
South. & Atl.	65	75
W. U. Tel.	77	77⅛
W. U. Scrip.	64	65
W. U. Bonds	123	.....
Mut. U. Bonds	87	88
TELEPHONE.		
Am. Bell	213	214
Am. Speaking	110	115
Erie	27½	28
*Hudson River	.....	55

TELEPHONE.	Bid.	Asked.
Mexican	1½	.....
*N. Y. & N. J.	78	75
N. Y. & Pa.	.....	.....
New England	44½	45
*Southern Bell	100	130
ELECTRIC LIGHT.		
*Am. Electric	.....	16
*Brush	.....	.....
*Brush Ill	.....	.....
*Consolidated	.....	.....
*Daft	.....	100
*Edison	131	.....
*Edison Ill	87½	95
*Edison Isolated	40	.....
*United States	42½	.....
*U. S. Ill	65	.....
MOTOR.		
*Daft	.....	.....
*Sprague	600	.....

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver steel and iron wire, shafting tools, etc.

Magnetism in Watches.—

THE UNITED STATES ELECTRIC LIGHTING CO.

C. C. WARREN, 216 *La Salle Street*,
Manager Western Department.

CHICAGO, Feb. 10, 1885.

Messrs. Giles, Bro. & Co.:

GENTLEMEN: I have now been carrying my watch encased in one of your Anti-Magnetic Shields for about a year, and it affords me pleasure to state to you that notwithstanding I have been very much about dynamo-electric machines during the time named, the anti-magnetic case seems to protect the watch perfectly from the magnetic influence of the machines. I have not made any special electrical tests, inasmuch as I regard the good running of the watch as all that is necessary. I am thoroughly convinced, from the effect upon my own watch, that the case is an excellent protection, and I may almost add an absolute preventive of magnetic influence from external sources to the delicate movements of a watch. My watch is a Howard watch, and during the period of two or three years previous to encasing it with your anti-magnetic case it had varied to a very great extent, and I had it demagnetized on two different occasions. I regard your case as a complete success, and if my indorsement of same is of any value, you are at liberty to use it.

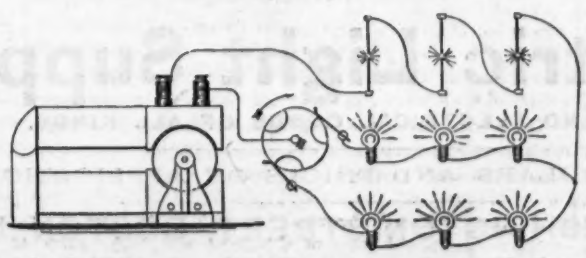
Yours truly,

C. C. WARREN, *Manager Western Dept.,*
The U. S. Electric Lighting Co.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED OCT. 12, 1886.

(1) 350,482. Electric Lighting System. (2) 350,668. Electric Motor; Philip Diehl, Elizabeth, N. J. 1. In the external circuit of a generator are placed translating devices which are adapted to be operated by a continuous current of one direction, such as arc lamps. Beyond these translating devices the main circuit is divided into two or more branches, and in each of them are included the primaries of one or more inductoriums, the secondaries of which include each one or more translating devices adapted for operation by alternating currents, such as incandescent electric lamps. The inductoriums may constitute a part of the translating devices which they operate. At the branching point a circuit-changer directs the current intermittently through the different branches. The main circuit is never broken. [See illustration.] 2. The armature consists of a sectional ring whose parts are held together by a central shaft



350,482. ELECTRIC LIGHTING SYSTEM.

350,519. Cut-Out for Electric Lamps; Leonidas G. Woolley, Indianapolis, Ind., Assignor to Henry H. McGaffey and Chester Bradford, same place. The armature of an electro-magnet in a shunt circuit around a lamp is connected with a bridge-piece which, after being started by the operation of the magnet, is operated still further by a spring so as to close a short-circuit around the lamp.

350,548. Universal Electric Damper and Fire Alarm; Edward A. Morley, Lee, Mass. Operates dampers, and thereby regulates the temperature of an inclosed space. The same devices which control the dampers may send in fire alarm.

350,610. Automatic Telephone Call; Charles F. Willis, Fergus Falls, Minn., Assignor of one half to Alva H. Kirk,

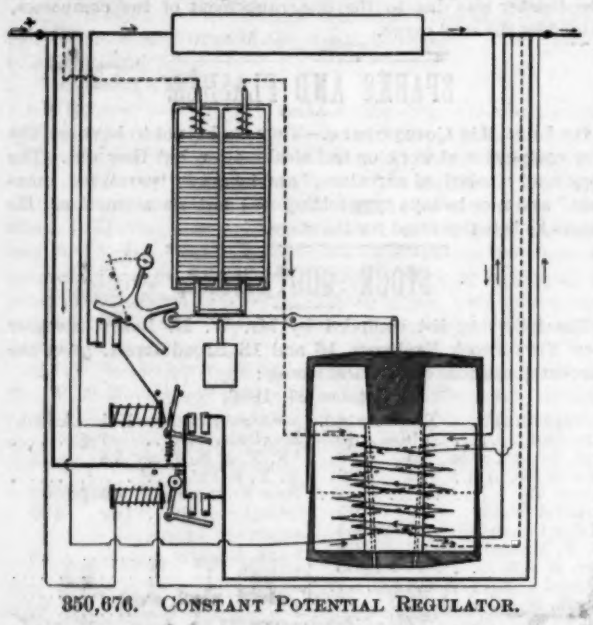
same place. No other call is sounded except that of the person with whom it is desired to communicate.

(1) 350,615. Printing Telegraph; (2) 350,616. Printing Telegraph; (3) 350,617. Printing Telegraph Transmitter; Charles L. Buckingham, New York, N. Y. (1) The invention includes, among other things, two type-wheels, one provided with letters to print the name of an article in one line and the other with figures to print its price in a second line. (2) The object is to avoid arresting, during the operation of printing characters, the rotating pulsator usually employed for sending short electric impulses over the line and usually arrested to prolong the impulses. (3) Improvement on the preceding to adapt it to use in a system employing two circuits.

350,621. Galvanic Battery Cell; Luis Drescher, New York, N. Y. A rubber stopper closes the open end of the cell, and a cylinder of carbon is united to the stopper by a platinum wire, the wire being carried through the rubber from one edge of the cylinder to a central plate or button on the opposite face of the stopper.

350,626. Hotel Call, Fire Alarm and Indicator; Albert T. Hess and Hans A. Stoltenberg, Des Moines, Ia.; said Stoltenberg Assignor to said Hess. A system of communication by call-bell and indicators between the hotel office and any or all the rooms, and between the office or any room and an engine-house.

350,634. Signaling Apparatus for Police Telegraphs; Lewis H. McCullough, Richmond, Ind., Assignor to the Richmond Fire Alarm Company, same place. A visual



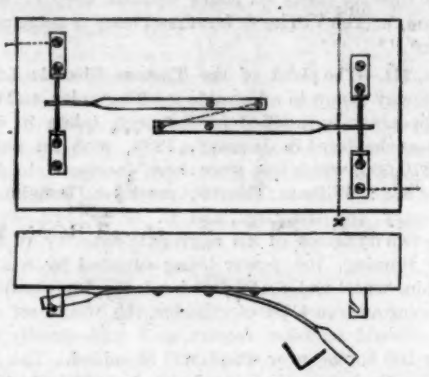
350,676. Constant Potential Regulator.

signal is located at each signal-box in a fire, district, or police telegraph system, and apparatus is provided at a central station whereby the signal at any desired box can be operated.

350,644. Transmitter and Sounder; George W. Stewart, New York, N. Y., Assignor of one-half to Stephen J. Cox, same place. The instrument can be used either for transmitting or receiving telegraphic messages. The parts are all located within the casing of an electro-magnet. The armature of the magnet can be depressed mechanically and, by closing an electric circuit be made to serve as a transmitter.

350,648. Safety Cut-Out for Electric Circuits; Edwin R. Whitney, Manchester, N. H., Assignor to the Forsaith Electrical Machine Company, same place. The cut-out consists of a wire loosely mounted in hangers. A spring bears upon the wire, and when the latter is softened by an excess of current, throws it out of its bearings and breaks the circuit of which it formed a part. [See illustration.]

350,676. Constant Potential Regulator; Carl Hering, Philadelphia, Pa. The object is to maintain the electrical



350,648. Safety Cut-Out for Electric Circuits.

potential constant at the poles of a variable resistance, such as a motor or an electroplating bath. A magnet is wound with a wire whose ends are connected to the poles which are to have a constant potential. When, from any cause, the difference of potential at the poles increases, the current in the magnet will increase. By this action the magnet armature is operated, thereby decreasing an adjustable resistance in an "overflow" circuit and increasing the overflow current until the potential has fallen to normal. [See illustration.]

350,715. Telephone Circuit; John A. Barrett, Brooklyn, N. Y., Assignor to the American Telephone and Telegraph Co., New York, N. Y. A system of duplexing telephone lines. [For description, see Electrical World, Oct. 23, 1886.]

350,728. Electric Motor or Generator; Frank E. Fisher, Detroit Mich. [For description, see page 213, this issue.]

350,737. Telephone Trumpet; Edward L. Hall, Baltimore, Md., Assignor to Louis Nelke, same place. The trumpet comprises a tube with a flaring mouth and a sound-wave divider having a central passageway and secured within the tube.

350,754. Regulator for Dynamo-Electric Machines; Osborn P. Loomis and Henry W. Cooley, Lynn, Mass. The object is to regulate the magnetic field without abruptness, and the invention consists broadly in placing a variable resistance in a shunt around one of the field-magnets. [See illustration.]

350,772. Telephone Transmitter; George L. Roberts, Boston, Mass., Assignor to the American Bell Telephone Co., same place. [For description, see page 214, this issue.]

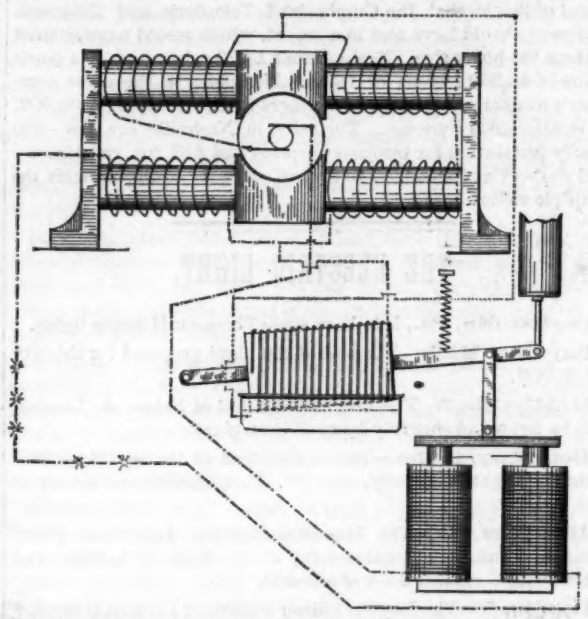
350,790. Railway Signal; Pierson J. Wicks, Greenpoint, N. Y. The invention provides means whereby a bell in the cab of a locomotive is automatically sounded as soon as two or more trains come upon adjoining sections of a railway track, or are in dangerous proximity to each other at a crossing.

350,804. Fire Alarm Telegraph System; Sidney A. Chase, Evart, Mich., Assignor of one-half to William R. Mapes, same place. All the stations of the system are connected in an earth circuit having its termini at the central office, and each station has an open ground connection. On the occurence of a break the central office is automatically signaled, and no station is cut out unless a break occurs on both sides of it.

350,823. Apparatus for Protecting Safes and Vaults; Joseph Fleckinger, Allegheny, Pa. The safe or other structure to be protected is inclosed by a cage or the approach thereto is guarded by a gate which cannot be opened without changing the condition of an electric circuit and sounding an alarm.

(1) 350,828. Machine for Winding Armatures; (2) 350,829. Junction Clamp for Electric Wires; Lucien Bigelow Jones, Bedford, Assignor to the Forsaith Electrical Machine Co., Manchester, N. H. (1) The machine consists of an annular spur-wheel carrying a spool and having part of its periphery removable, and a platform capable of being rotated in a plane at right angles to the plane of revolution of the spur-wheel, and means for revolving the spur-wheel and moving the platform laterally. (2) The clamp is designed to connect main and branch wires. It is made of conducting material and joined directly to the branch wire, but is insulated from the main wire except through the screw which forms the means of attaching the clamp to the wire.

350,882. Multiple Call Box; Charles Herrmann, New York, Assignor to William J. Matheson, Brooklyn, N. Y. An auxiliary wheel is mounted on the ordinary break wheel outside the centre of the latter. Means are provided for making



350,754. Regulator for Dynamo Electric Machines.

and breaking contact through the auxiliary wheel so as to transmit a variable signal.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.

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" " Door " "	1.50	Novelty A Battery.....(doz. lots), each.	1.15
Push Buttons, Walnut, Ash, etc., per 100.	8.00	Novelty Disque Battery (case lots 50), each.	.55
Hollow Base Switch, Walnut, etc., per 100.	20.00	Novelty Disque Battery Zincs (the best), per 100.....	50.00
Floor Push.....per doz.	3.60	Morse Telegraph Outfit, com. with battery.	3.00
Four-Point Needle Annunciator, with Bell.	5.00		

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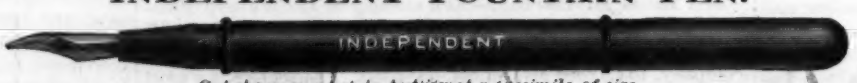

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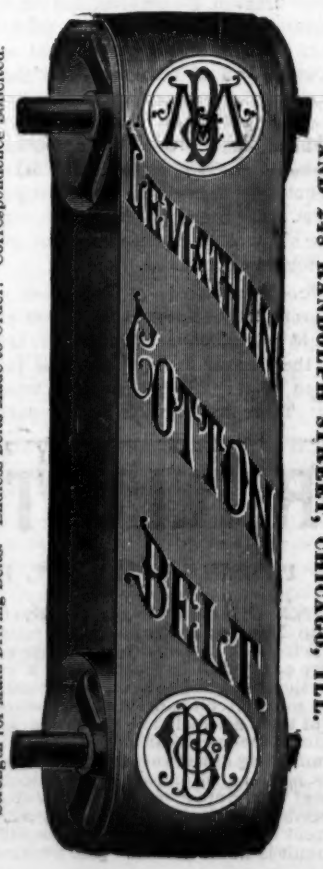

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